LEGISLATIVE RESEARCH COMMISSION

COASTAL WATER QUALITY

REPORT TO THE
1987 GENERAL ASSEMBLY
OF NORTH CAROLINA

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STATE OF NORTH CAROLINA

LEGISLATIVE RESEARCH COMMISSION

STATE LEGISLATIVE BUILDING

RALEIGH 27611

December 12, 1986

TO THE MEMBERS OF THE 1987 GENERAL ASSEMBLY:

The Legislative Research Commission submits to you for your consideration its report on coastal water quality. This report was prepared by the Legislative Research Commission's Committee on Coastal Water Quality pursuant to Chapter 1014 of the 1985 Session Laws (Regular Session, 1986).

Respectfully submitted,

J. J. (Monk) Harrington

Liston B. Ramsey

Cochairmen

Legislative Research Commission

1985-87

LEGISLATIVE RESEARCH COMMISSION MEMBERSHIP

House Speaker Liston B. Ramsey, Cochairman	Senate President Pro Tempore J. J. Harrington, Cochairman
Representative Chris S. Barker, Jr.	Senator Henson Barnes
Representative John Church	Senator A. D. Guy
Representative Bruce Ethridge	Senator Ollie Harris
Representative Aaron Fussell	Senator Lura Tally
Representative Barney P. Woodard	Senator Robert Warren

PREFACE

The Legislative Research Commission, established by Article 6B of Chapter 120 of the General Statutes, is a general purpose study group. The Commission is cochaired by the Speaker of the House and the President Pro Tempore of the Senate and has ten additional members, five appointed from each house of the General Assembly. Among the Commission's duties is that of making or causing to be made, upon the direction of the General Assembly or either house thereof, "such studies of and investigations into governmental agencies and institutions and matters of public policy as will aid the General Assembly in performing its duties in the most efficient and effective manner" (G.S. 120-30.17(1)).

At the direction of the 1985 General Assembly, the Legislative Research Commission has undertaken studies of numerous subjects. These studies were grouped into ten broad categories and each member of the Commission was given responsibility for one category of study. The co-chairmen of the Legislative Research Commission, under the authority of General Statute 120-30.10(b) and (c), appointed committees consisting of members of the General Assembly and the public to conduct the studies. Co-chairmen, one from each house of the General Assembly, were designated for each committee.

The study on coastal water quality was authorized by Section 152 of Chapter 1014 of the 1985 Session Laws (Regular Session,

1986). That act states that the Commission may perform a comprehensive study and re-evaluation of coastal water quality classifications and may also evaluate existing and proposed rules of any State agency regarding coastal water quality. The relevant portion of Chapter 1014 is included in Appendix A.

The Legislative Research Commission grouped this study in its environment area under the direction of Representative Bruce Ethridge. The Committee was chaired by Representative Margaret Stamey and Senator Marc Basnight. The full membership is listed in Appendix B of this report. A copy of this report is filed in the Legislative Library. A Committee notebook containing the Committee minutes and all information presented to the Committee is also filed in the Legislative Library.

COMMITTEE PROCEEDINGS

The Coastal Water Quality Study was authorized by the 1985 General Assembly during the 1986 Regular Session. Despite the brief time allotted for the study, the Committee worked diligently to gain a solid understanding of the complex issues involved in water quality protection. Speakers from State and federal agencies addressed the Committee on legal and scientific principles adopted to safeguard water quality. Additional information was provided comparing approaches adopted by other states when addressing similar issues. The Committee also provided a forum for members of the public to indicate their concerns about the State's water quality.

A brief discussion of each committee meeting follows.

The Committee's first meeting focused on the State's current water classification system and water quality standards. Representatives from the Department of Natural Resources and Community Development and the Department of Human Resources outlined the system of coastal water classifications and explained the standards adopted to protect those classifications. The role played by various agencies in protecting water quality was also acknowledged.

Paul Wilms, Director of Environmental Management, directed the Committee's attention to eight major issues to consider in studying coastal water quality and briefly discussed each. The eight issues identified by Mr. Wilms were:

(1) Storm water,

(2) Use classification,

(3) Marinas,

(4) Eutrophication,

(5) Agricultural runoff and drainage,

(6) Peat mining,

(7) Fisheries decline, and

(8) Upstream pollution.

He also indicated that additional research is needed in three areas: water classifications, storm water control requirements, and runoff-groundwater interactions, particularly the recharge rate of ground waters.

In an explanation of the State water classification system, Mr. Wilms discussed the effect of water quality on the suitability of shellfish to be harvested as a food crop. The discussion clarified that shellfish are particularly sensitive to pollution and will absorb it. If a mollusk is eaten before it purges itself of the pollution, it can cause illness in a human being. For this reason, shellfish waters are a focal point in the development of water classifications and water quality standards. Further discussion of this topic indicated several issues related to the identification of shellfish grounds. Many disagree as to the appropriate criteria for determining whether a significant shellfish resource exists in waters. Even if a shellfish resource does exist, some marine authorities feel that a distinction between commercial and recreational shellfish harvesting is appropriate.

Documentation on the various reasons for closures of shellfish grounds was also provided to the Committee.

Dr. William Hogarth, Director of the Marine Fisheries Division, focused his discussion with the Committee on the importance of the fishing industry in North Carolina and the effect pollution has on that industry. He indicated that the fishing industry in North Carolina generates approximately two billion dollars for the State. He reiterated that storm water runoff does affect shellfish and that coastal land clearing and drainage are major contributors to runoff.

David Owens, Director of the Coastal Management Division, identified the problems caused by marinas as a major area of concern to his division. He indicated that additional study is needed to isolate the problems caused by marinas and to develop solutions to those problems. He also indicated that there is disagreement as to the appropriate definition of "marina". Robert Benton, Supervisor, Shellfish Sanitation Division of the Department of Human Resources, discussed the role of that division in protecting water quality. The Shellfish Sanitation Branch adopts rules for the sanitary control of shellfish, classifies shellfish growing areas, inspects plants, samples areas, and checks for fecal coliform which is an indicator of possible sewage contamination. He also discussed water quality problems caused by sanitation and drainage problems.

The Committee conducted the last part of the meeting as a forum for members of the public to indicate specific concerns about coastal water quality. Those addressing the Committee represented a wide variety of interests and backgrounds and called attention again to the complexity of the problems facing the Committee. A list of the speakers is included in the appendices

of this report.

At its second meeting, the Committee focused on federal regulations affecting water quality classifications and standards, the "Critical Area Management Plan" recently adopted by the state of Maryland to address water pollution problems in the Chesapeake Bay, further explanation of the details of North Carolina's water classification system, and two proposals to adopt new water quality classifications and standards for North Carolina.

Representatives from the Environmental Protection Agency (Region IV) outlined the federal laws and regulations that apply to water quality protection. The primary goal of the Clean Water Act is to assure that water quality provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the waters. The Act includes minimum treatment requirements to which all source points must adhere.

The water quality section of the Act was explained in detail to the Committee.

The term "water quality standards" refers to the use of waters and the criteria developed to protect that designated use of the waters. Frequently, water quality standards reflect the goal of a body of water and are not really a description of the body's current water quality.

The antidegradation policy is also part of the water quality standards. This policy protects the quality of waters classified at a certain level by prohibiting uses of the water that would lower the quality below the standards that define the water's present classification. States are required under the federal regulations to adopt antidegradation policies and to identify

methods for implementing the policy.

Another aspect of the classification process mandated by federal law is that state water classifications and water quality standards must be approved by the Environmental Protection Agency (E.P.A.). Once E.P.A. approval is received, state standards become the accepted federal standards for that state and are enforceable at both state and federal levels. If the state standards are not approved by E.P.A., then E.P.A. will promulgate water quality standards as needed for a state.

A second point to this process is that once state standards receive E.P.A. approval, any revision of the standards must also receive E.P.A. approval. Federal regulations require public notice and public hearings prior to revisions of water classifications or standards.

Although revisions to water classifications and standards that would lower the existing classifications or standards are generally prohibited by E.P.A., there are six criteria under which E.P.A. will allow waters to be classified at a lower use. Those criteria follow:

(1) A naturally occurring pollutant or condition prevents the attainment of a designated use;

(2) Natural, ephimeral, intermittent flow conditions prevent the attainment of the use;

(3) Human conditions or sources of pollutant prevent the attainment of the use and correcting these conditions or sources would cause more damage to the environment;

(4) Dams, diversions, or other types of hydrologic

modifications preclude the attainment of the use;

(5) Physical conditions related to the natural features of the water body preclude the use; or

(6) Widespreaad economic and social impacts would result from cleaning up an existing source of pollution.

However, a state may not remove a designated use from a body of water if the use can be attained by implementing cost effective and reasonable best management practices for nonpoint source control.

Responding to questions from the Committee members, speakers advised the Committee that storm water runoff is a threat to water uses and that states are required to develop policies to deal with nonpoint sources.

After lunch, the Committee heard a detailed presentation on the Critical Area Program in Maryland. The plan has the following goals: to clean up the Chesapeake Bay, upgrade sewage treatment plants, remove nutrients from the water, construct hatcheries, plant shelves, develop storm water management and sediment control plans, expand forest management, and identify watersheds that should receive priority for best management practices on farmlands. The program was developed at the state level, but is applied on a local level. To accomplish the goals enumerated above, the program mandates low density development and requires buffers to protect particularly sensitive areas.

During the last part of the meeting, Representatives from the Department of Natural Resources and Community Development provided information requested by Committee members at the first meeting and Committee discussion followed. Senator Marc Basnight proposed

several ideas for the Committee's consideration: a reclassification use attainability study, urban runoff study, mapping of shellfish resources, shellfish enhancement program, fish hatchery facilities, and stricter controls on septic tank use.

Mr. Ken Kirkman presented two proposals to adopt new water classifications and water quality standards, One proposal was prepared by Mr. Kirkman; the other by Ken Stewart, a member of the North Carolina Alliance for Balanced Coastal Management. Copies of both proposals appear in Appendix D. The proposals were discussed. Over the objection of some members, the Committee voted to endorse the concept of adopting new water classifications and agreed that the Committee suggest to staff what the several characteristics of those classifications should be. However, no specific details were adopted by the Committee.

At the third meeting, the Committee heard comments from five more speakers and devoted the remaining time to discussion of the issues.

Remarks addressed to the Committee included further explanation of conflicts that arise with multiple uses of water, new designs for building materials to eliminate storm water runoff, and highway designs being considered by the Department of Transportation to comply with State storm water regulations.

Recommendations for the Committee's consideration were presented by the Coastal Federation, the Department of Natural Resources and Community Development, and Mr. Ken Kirkman. Copies of all three sets of proposals appear in Appendices E, F, and G. After consideration of all the proposals and some discussion, a

majority of the Committee voted to adopt in concept those recommendations proposed by Mr. Kirkman. Two members expressed reservations about the proposals and voted against the Committee's motion.

A final recommendation presented by Mr. Kirkman to the Committee was also adopted by a majority of the Committee and is included in the discussion of the Committee's recommendations which appears in the "Findings and Recommendations" portion of this report.

At its fourth and final meeting, the Committee reviewed and approved this report to the Legislative Research Commission.

ISSUES AND FINDINGS

The Committee's study of coastal water quality covered a broad range of issues. Because these issues are interrelated, it is often difficult to define clearly when consideration of one issue ends and consideration of a new issue begins. This difficulty reflects the complexity of the problems addressed by the Coastal Water Quality Study Committee.

During its study the Committee sifted through complicated legal discussions, techincal scientific explanations, and conflicting water use philosophies to determine the appropriate focus for the Committee's attention. Four main areas of concern evolved: the appropriate classification of coastal waters and water quality standards, problems created by storm water runoff and effective methods of addressing those problems, Statewide water quality problems that affect coastal waters, and the enhancement of coastal resources.

The Committee's consideration of the above areas and related issues follows.

Water quality classifications and standards

The current classification of State coastal waters was developed and assigned to waters between 1956 and 1963. There are eight classifications. Four of these classifications are assigned to nonsaline waters and four of these classifications are assigned to saline waters. The Committee focused its discussions on the classifications listed below which are for saline waters:

Outstanding resource waters: a new category not yet assigned to any waters;

Class SA: suitable for commercial shellfishing and all other tidal salt water uses;

Class SB: suitable for swimming and primary recreation and all class SC uses; and

Class SC: suitable for secondary recreation and fish propagation.

The Committee heard extensive discussion about whether the current classification system should be revised. Most people agreed that modification of the current classification system is appropriate. The disagreement expressed on this issue pertained to the degree of modification that is needed and the best method to develop and assign water classifications and water quality standards.

To develop a new water classification system for State coastal waters, requires three main tasks.

(1) A classification series must be developed;

(2) Standards must be established for each classification to safeguard that classification; and

(3) Appropriate classifications must be assigned to segments of marine waters.

Generally, classifications reflect the best use that can be made of a body or segment of water. Because the best use that can be made of different segments of water varies, classification schemes have several categories to balance the need for conflicting usages. Thus, to develop an appropriate classification series for the State it is necessary to identify the "best use" of each body or segment of water and to include sufficient categories in the classification series to differentiate between the identified uses.

Determinations of the best use of waters (and the assignment of appropriate classification to those waters) should be based on use attainability studies and inventories of State shellfish resources. An additional matter to consider in identifying the best use of waters is an appropriate definition of the term "existing shellfish use". As mentioned earlier in this report, shellfish grounds are a focal point in developing classification schemes because of their sensitivity to pollution. Thus, a clear defintion of "existing shellfish use" is essential.

Standards serve as guidelines to to protect the classifications. The standards indicate physical, chemical, or biological properties that may threaten the contemplated best use of the waters. Often, they set the maximum amount of a potentially harmful property that can be discharged into a body of water, and not affect the best use of the water. Under federal regulations, states must also include an antidegradation policy as part of their water quality standards.

Generally it was agreed that the technical aspects of standards should be developed by those who had the requisite scientific and technical knowledge. However, two concerns were addressed with regard to the antidegradation part of the standards. The terms "existing shellfish use" and "marinas" should be defined. The reasons for defining the term "existing shellfish use" have been discussed above. The reason for adopting a clear definition of "marinas" is also related to shellfish grounds. A marina is viewed as a potential pollutant if shellfish waters are located in close proximity to the marina. This is due in part, to the type of waste that may be discharged into the water if the boats docked at the marina and the marina itself have inadequate pollution controls. If an appropriate buffer cannot be maintained around the marina, the Shellfish Sanitation Branch may close nearby shellfish grounds based on public health policies. However, some boats and marinas are equipped with proper pollution control devices and the threat of pollution posed by these marinas is limited. The current definition makes no allowance for this type of distinction among marinas. A more accurate definition should be considered to make this distinction.

Shellfish grounds are closed by the Secretary of the Department of Natural Resources and Community Development who acts upon the recommendation of the Shellfish Sanitation Unit (Sanitation Branch, Environmental Health Section, Division of Health Services, Department of Human Resources), which is charged with monitoring the suitability of shellfish for harvest by recreational and commercial fishermen. Recommendations by the

Shellfish Sanitation Unit for the closure of shellfish grounds are based on public health policies adopted by the Department of Human Resources, which are based on guidelines approved by the federal Food and Drug Administration and the Interstate Shellfish Sanitation Conference. The development of procedures and guidelines for the closure of shellfish grounds by appropriate State agencies is needed.

Appropriate assignment of classifications to coastal waters is essential to the success of a new classification system in North Carolina. Data from the use attainability study and the mapping of shellfish resources mentioned earlier will assist in the proper assignment of classifications to waters.

Storm water standards

Numerous comments and materials on storm water and its effect on water quality were directed to the Committee. Current storm water regulations in North Carolina and other states were studied and storm water management alternatives considered by the Committee.

The Committee noted that appropriate storm water standards should be tied to each water classification. (See recommendation #11 for further clarification.)

Statewide water quality issues

The Committee noted that many water quality problems exist Statewide. However, many of these problems are addressed by rules and standards that apply only in the coastal counties. The

Committee emphasized that the quality of coastal waters is affected by pollution that originates upstream in waters across the State as well as pollution originating in coastal counties. The Committee also indicated that to address water pollution problems adequately, the same water quality protection standards should be applied throughout a river basin.

Coastal resource enhancement

The Committee recognized that North Carolina's coastal resources are irreplacable and deserve both protection and enhancement. The fishing industry generates approximately two billion dollars for the State. Additional revenue is produced by the industries of tourism and development. However, the success of all of these industries is tied to the natural beauty and the natural resources of the State. Special efforts should be made to assure the protection of natural resources and to maintain a healthy economy.

RECOMMENDATIONS

Based on the information, comments, and materials presented during its meetings, the Committee adopts in concept the following recommendations.

(1) Direct the Environmental Management Commission to adopt a new coastal water quality classification system with an adequate number of categories to differentiate clearly the true "best and existing uses" of State coastal waters;

(2) Require that all coastal waters be inventoried specifically for shellfish and for other resource values as required for reclassification;

(3) Authorize funding for the Division of Environmental Management to conduct use attainability studies and apply the new classification system;

(4) Authorize funding for the Division of Marine Fisheries to conduct an inventory of shellfish and other resource values of the coastal waters;

(5) Define the term "existing use" for regulatory purposes so that State agencies can determine if a project violates antidegradation standards;

(6) Direct that the statutory means for shellfish closures be examined and require that the appropriate agencies develop and adopt procedures and guidelines for shellfish area closures;

(7) Authorize funding for the Division of Environmental Management for a new environmental laboratory with state of the art water quality testing procedures;

(8) Direct that the standards and procedures currently in use to protect water quality be evaluated and develop improved tests and standards as appropriate;

(9) Designate one agency to have the responsibility for coastal water quality protection;

(10) Authorize additional funding for basin-wide water quality studies to identify pollution sources and develop appropriate tools to address them;

(11) Evaluate storm water management alternatives and require that regulations apply consistently throughout the drainage basin. Appropriate storm water rules should be applied to each of the water quality classifications when developed as provided in Recommendation #1;

(12) Require expeditious permit processing in CAMA and DEM;

(13) Establish mitigation as an acceptable regulatory tool to offset environmental losses and enhance coastal resources;

(14) Authorize funding for a fish hatchery to enhance fin fish and shellfish production;

(15) Authorize additional funding for the Division of Marine Fisheries for the Shellfish Relocation Program;

(16) Authorize additional funding for fisheries research;

(17) Define the term "marinas" for regulatory purposes with a differentiation between types of marinas;

(18) Establish a regulatory and cost-share program to address water quality cleanup of existing pollution sources with special emphasis on areas adjacent to shellfish resources;

(19) Zoning or land use planning is an appropriate tool for land management and may be considered as a management tool for coastal areas;

(20) Recommend that numerical standards for the Chowan River be adopted.

(21) Direct that the vertical separation in existing regulations be studied and appropriate regulations to protect the water table be considered.

(22) Authorize additional funding to continue this Study Committee for an additional year;

(23) Recommend that this Committee continue to monitor any action taken on the above recommendations for the twelve-month period.

APPENDIX A

GENERAL ASSEMBLY OF NORTH CAROLINA

1985 SESSION (REGULAR SESSION, 1986)

RATIFIED BILL

CHAPTER 1014
HOUSE BILL 2055

AN ACT TO MODIFY THE CURRENT OPERATIONS AND CAPITAL IMPROVEMENTS APPROPRIATIONS FOR NORTH CAROLINA STATE GOVERNMENT FOR THE 1986-87 FISCAL YEAR, TO APPROPRIATE FUNDS FOR LOCAL NEEDS, AND TO MAKE OTHER CHANGES IN THE BUDGET OPERATION OF THE STATE.

The General Assembly of North Carolina enacts:

PART I.-----APPROPRIATIONS FOR THE MAXIMUM AMOUNT NECESSARY

Section 1. The appropriations made in this act, except the appropriations in Sections 8 through 18 of this act, are for maximum amounts necessary to provide the services and accomplish the purposes described in the budget. Savings shall be effected where the total amounts appropriated are not required to perform these services and accomplish these purposes and, except as allowed by the Executive Budget Act or this act, the savings shall revert to the appropriate fund at the end of each fiscal year.

PART II.-----CURRENT OPERATIONS/GENERAL FUND

Sec. 2. The items and amounts appropriated from the General Fund for the 1986-87 fiscal year in the 1986-87 column of the schedule in Section 2 of Chapter 479 of the 1985 Session Laws are repealed, and appropriations from the General Fund for the maintenance of the State departments, institutions, and agencies and for other purposes as enumerated are made for the fiscal year ending June 30, 1987, according to the following schedule:

Current Operations-General Fund	1986-87
General Assembly	$ 14,535,233
Judicial Department	129,816,241
Department of The Governor	8,725,535
Office of State Budget and Management Reserve for Grant-in-Aids	1,697,213
Lieutenant Governor's Office	473,834
Department of Secretary of State	1,848,166
Department of State Auditor	11,370,292
Department of State Treasurer	6,455,304
Department of Public Education	2,032,862,775
Department of Justice	37,630,760
Department of Agriculture	30,615,220

Department of Labor	5,616,103
Department of Insurance	9,257,802
Department of Administration	39,689,329
Department of Transportation	
01. Public Transportation	1,645,000
02. Aeronautics	3,516,571
03. Aid to Railroads	1,100,000
Total Department of Transportation	6,261,571
Department of Natural Resources and Community Development	56,258,159
Department of Human Resources	
01. Alcoholic Rehabilitation Center-Black Mountain	2,719,270
02. Alcoholic Rehabilitation Center-Butner	2,327,619
03. Alcoholic Rehabilitation Center-Greenville	2,003,180
04. N.C. Special Care Center	3,146,283
05. Black Mountain Center	3,775
06. DHR-Administration and Support Program	23,489,971
07. Schools for the Deaf	13,168,122
08. Governor Morehead School	3,847,330
09. Division of Health Services	71,323,104
10. Social Services	77,734,525
11. Medical Assistance	220,871,223
12. Social Services-State Aid to Non-State Agencies	4,129,646
13. Division of Services for the Blind	5,390,994
14. Division of Mental Health and Mental Retardation Services	114,152,288

council of government is allocated an amount up to fifty-five thousand dollars ($55,000) with the actual amount calculated as provided in subsection (b) of this section.

(b) The funds shall be allocated as follows: A share of the maximum fifty-five thousand dollars ($55,000) shall be allocated to each county and smaller city based on the 1980 Federal Census population of that county (less the population of any larger city within that county) or smaller city, divided by the sum of the total population of the region (less the population of larger cities within that region) and the total population of the region living in smaller cities. Population totals shall be according to the 1980 Federal Census, except to account for cities incorporated since the return of that census, and in such case, the most recent annual estimate of the Office of State Budget and Management shall be used. Those funds shall be paid to the regional council of government to which that county or city belongs upon receipt by the Office of a resolution of the governing board of the county or city requesting release of the funds. If any city or county does not so request payment of funds by June 30, 1987, that share of the allocation shall revert to the General Fund.

(c) A council of governments may use funds appropriated by this section only to assist local governments in grant applications, economic development, community development, support of local industrial development activities, and other activities as deemed appropriate by the member governments.

(d) Funds appropriated by this section may not be used for payment of dues or assessments by the member governments, and may not supplant funds appropriated by the member governments.

(e) As used in this section "Larger City" means an incorporated city with a population of 50,000 or over. "Smaller City" means any other incorporated city.

-----COASTAL WATER QUALITY STUDY

Sec. 152. The Legislative Research Commission may perform a comprehensive study and reevaluation of coastal water quality classifications. The Commission may also evaluate existing and proposed rules of the Environmental Management Commission, Coastal Resources Commission, the Marine Fisheries Commission, and any other State agency regarding coastal water quality. The Commission may report its findings and any recommended legislation to the 1987 General Assembly.

-----REMOVE RESTRICTION ON WILDLIFE RESOURCES COMMISSION'S USE OF SALES TAX FUNDS

Sec. 153. The second sentence of Section 88(c) of Chapter 1116 of the 1983 Session Laws, Regular Session 1984, is repealed.

PART XII.-----AGRICULTURE

-----BROILER BREEDER RESEARCH PROGRAM/TRANSFER OF FUNDS

Sec. 154. Pursuant to G.S. 146-30, there is transferred from the Department of Agriculture timber sales capital improvement account to the Department of Agriculture for the 1986-87 fiscal year the sum of one hundred seventy-five thousand dollars ($175,000). These funds shall be used to complete the broiler breeder research program at the Piedmont Research Station.

APPENDIX B

LEGISLATIVE STUDY COMMITTEE

COASTAL WATER QUALITY

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APPENDIX C

SPEAKERS AT COMMITTEE MEETINGS

Robert Benton
Supervisor, Shellfish Sanitation Branch
Department of Human Resources

Dan Brock
Roosevelt Partnership, Inc.

Mike Corcoran
N.C. Wildlife Federation

Ned Delamar
N.C. Fisheries Association

Glenn Futrell
President, Soil & Material Engineers, Inc.

Tom Herrington
Regional Shellfish Specialist
Federal Food and Drug Administration

W.T. Hogarth
Director, Marine Fisheries Division
Natural Resources & Community Development

Jim Kennedy
North Carolina Coastal Federal

Mike McGhee
Water Management Division
Environmental Protection Agency

Ken Mitchell
N.C. Home Builders Association

Kent Mitchell
Balhead Island

Lynn Muchmore
Assistant Secretary
Department of Natural Resources & Community Development

Lawrence Neville
Regional Counsel Office
Environmental Protection Agency

Marion Nichol
Conservation Council

Mike Orbach
Chairman, Marine Science Council

Dave Owens
Director, Coastal Management Division
Natural Resources & Community Development

Ken Stewart
N.C. Alliance for Balanced Coastal Management

Kevin Sullivan
Science Advisor, Maryland Critical Area Commission

Ted Waters
Assistant Highway Administrator
Dept. of Transportation

Paul Wilms
Director, Division of Environmental Management
Natural Resources & Community Development

APPENDIX D

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October 30, 1986

TO: Members of the Legislative Study Commission on Coastal Water Quality

FROM: Kenneth M. Kirkman

Attached hereto please find a layman's simplistic effort to set out general parameters of a proposed water reclassification system. What is proposed is designed to elicit comment and reaction from the Commission members, which comment and reaction I would hope could lead to a consensus whereby our Committee could recommend general parameters of a water classification system to be implemented in detail by the appropriate agencies. I think it important that a classification system be adopted prior to attempting to apply that classification to particular waters. That is, we need to come up with a logical approach to the classification, and then let the various interests struggle to determine the appropriate classification for each particular body of water. I have neither the training nor the time to attempt to define a comprehensive set of categorizations for each classification, and there are questions I have not dealt with in any way, such as buffers, coliform or metal standards, and the like. Thus, I am clearly open to criticism on all counts. Again, however, I think it most important that this Commission take a leadership role in formulating logical guidelines for the classification of the water systems of the coast of North Carolina, and we need a beginning point to use as a frame of reference in discussion. What I am suggesting has not been approved by any interest - developmental, environmental, municipal, or regulatory. I do think, however, these suggestions can form a beginning point for our deliberations.

DESIGNATION: #1 - Commercial Shellfish

DEFINITION: Highest and best use is harvesting of commercial shellfish.

INTENT: Exclude other uses to the extent required to insure maintenance of existing water quality, and to promote improved water quality.

DETERMINATION: Based upon a positive three-fold test:

(a) historical use by local, commercial shellfishermen;

(b) scientific analysis concluding that 25 bushels per acre of a shellfish species is to be anticipated;

(c) area has been closed to shellfishing on the average of two weeks or less per season for past five (5) years, or, if closed more frequently, closed due to an identifiable point source of pollution which can reasonably be corrected.

STORM WATER: Strictly controlled as to setbacks and adjoining uses to the extent scientific evidence determines runoff is a danger to shellfishing.

WASTE TREATMENT DISCHARGES: No sewage outfall allowed; significant setbacks for septic tanks.

MARINAS: Not allowed.

DESIGNATION: #2 - Recreational Shellfish

DEFINITION: Areas which support a significant shellfish resource, but which, due to location and historical use pattern and economic impact should support other uses as well.

INTENT: Regulate uses in and surrounding the area to the extent that it should be anticipated that temporary closings of shellfish waters would be infrequent.

DETERMINATION: Based upon a positive three-fold test:

(a) Historical use by shellfishermen;

(b) Scientific analysis concluding that less than 25 bushels per acre, but more than 10 bushels an acre, is anticipated;

(c) Area has been closed to shellfishing on the average of six (6) weeks or less per season for past five (5) years, or, if closed more frequently, closed due to an identifiable point source of pollution which can reasonably be corrected.

STORM WATER: Six months storm event (designed to protect first 1/2 inch of runoff) plus setback requirements, if any, imposed based on potential of a particular use to cause harmfull runoff.

WASTE TREATMENT DISCHARGES: No sewage outfall; setbacks for septic tanks.

MARINAS: Noncommercial marinas; limited boat sizes; upland basins only.

DESIGNATION: #3 - Shellfish Propogation

DEFINITION: Areas from which existing shellfish should be relocated if possible; human body contact is appropriate.

INTENT: The intent to maintain the area as a shellfish habitat; to not increase pollutants; to allow reasonably controlled development and alternative uses of the water. This area should provide the shellfish for relocation into areas #1 and #2.

DETERMINATION: Areas which support shellfish at 10 bushels per acre or greater, but otherwise do not classify for #1 and #2; areas which would classify under areas #1 and #2, but due to scientific analysis would be expected to support less than 10 bushels per acre of shellfish.

STORM WATER: No net increase over that naturally occurring from within 100 feet.

WASTE TREATMENT DISCHARGES: No sewage outfall; septic tank setbacks.

MARINAS: Noncommercial marinas in upland basins allowed; small, noncommercial marinas allowed along shoreline.

DESIGNATION: #4 - Primary Bathing Waters

DEFINITION: Highest and best use is swimming and other body contact water sports, and other water related recreational activities.

INTENT: To maintain a water quality suitable for human contact. Categories #4 and #5 should be utilized to procure public access points for water use by the public.

DETERMINATION: (a) Little historical shellfishing use of the waters for other than very casual shellfishing;

(b) Historical or expected use by significant numbers of bathers, recreational participants, and boaters;

(c) An area that tends to have a poor flushing rate to dissipate potential or existing pollutants.

STORM WATER: No restriction other than buffer.

WASTE TREATMENT DISCHARGES: No sewage outfall; septic tank setbacks.

MARINAS: Noncommercial marinas allowed, either upland or shoreline.

DESIGNATION: #5 - Recreational Waters

DEFINITION: Highest and best use is swimming and other body contact water sports, and other water related recreational activities.

INTENT: To maintain a water quality suitable for human contact. Categories #4 and #5 should be utilized to procure public access points for water use by the public

DETERMINATION: (a) Little historical shellfishing use of the waters for other than very casual shellfishing;

(b) Historical or expected use by significant numbers of bathers, recreational participants, and boaters;

(c) Due to good flushing, pollutants are expected to rapidly dissipate.

STORM WATER: Unrestricted, except for buffer.

WASTE TREATMENT DISCHARGES: Treated sewage disposal allowed; septic tanks allowed outside of buffer.

MARINAS: Noncommercial marinas allowed, either upland or shoreline.

DESIGNATION: #6 - Fishing

DEFINITION: Highest and best use is nonshellfish propogation, non-body contact fishing and boating.

INTENT: To maintain water quality suitable to fish propogation, and to promote the area for boating and fishing.

DETERMINATION: Areas not qualifying under any classification #1 through #5, and which have historically been used more for boating and fishing than recreational swimming, water skiing, or other water sports.

STORM WATER: Unrestricted.

WASTE TREATMENT DISCHARGES: Treated sewage outfalls allowed. Septic systems allowed within reasonable proximity.

MARINAS: Allowed without significant restriction.

DESIGNATION: #7 - Urban.

DEFINITION: Best use is boatage and drainage basin.

INTENT: To discourage these areas as a primary use for shellfishing, water contact sports, or fishing. Not appropriate areas for acquisition of public access areas.

DETERMINATION: An areas unsuitable for categories #1 through #6, due to heavy and existing development, or the reasonable likelihood, based on local zoning and land use plans, that commercial or industrial development will be located adjacent. Areas of traditional natural or manmade drainage reception. Area heavily polluted, with no likelihood of economic cure.

STORM WATER: Unrestricted.

WASTE TREATMENT DISCHARGES: Sewage allowed if appropriate under law; no restrictions on septic tanks.

MARINAS: Allowed without restriction.

WATER CLASSIFICATIONS

#1 Outstanding Resource Waters: Pristine commercial shellfish waters with 30+ bushels per acre and virtuality no pollution sources

#2 Shellfish Viable Waters: Recreational and low intensity commercial quantity with 10+ bushels of shellfish per acre and limited closings due to pollution

#3 Primary Body Contact Recreational Waters: Waters intensively used for swimming and other body contact water sports. Areas may also support some shellfish resources of a recreational quantity

#4 Multiple Use Waters: Well flushed areas suitable for body contact recreation, fishing, boating, etc.

#5 Fish Propagation Waters: Finfish and Shellfish propagation areas suitable for occassional body contact

	Sewerage Disposal	Stormwater Mgt.	Marinas	Agric. Drainage
#1	Not Allowed	10% Impervious All Projects 50' Setback 5 yr. Storm	Not Allowed	Not Allowed
#2	Not Allowed	25% Impervious All Projects 25' Setback 1 yr. Storm	Private Upland Marinas Only	Allowed with Filtering or Treatment
#3	Not Allowed	30% Impervious or Equiv. for Major Projects	Private or Upland Commercial	Allowed
#4	Tertiary Treated	30% Impervious on Lots with Septic System Major Projects Only	Allowed	Allowed
#5	Secondary Treated	No Requirements	Allowed	Allowed

* Gov't Cost Share Program to Mitigate Pollution Sources in #1 and #2
* Augment Relocation Program for Shellfish from #3, #4, #5 to #1 and #2

APPENDIX E

LEGISLATIVE STUDY COMMISSION

ON COASTAL WATER QUALITY

RESOLUTION

Whereas the 1985 General Assembly established a Legislative Study Committee on Coastal Water Quality; and,

Whereas the Study Committee has held several meetings and received numerous presentations regarding coastal water quality problems, sources of pollution, inadequacy of current program and staff, lack of research data, adverse economic impact on coastal development interests, and problems with the water classification system and its application; and,

Whereas the coastal region is rich in environmental resources which are important to fishermen, tourists and developers alike; and,

Whereas there are justifiable concerns about declining water quality and adverse impacts on coastal resources including shellfish, finfish, and human recreational uses; and,

Whereas the State of North Carolina has developed and adopted a water classification system with only three categories and applied these categories without benefit of a comprehensive inventory of coastal resources; and,

Whereas there are many areas that are improperly classified under the present system; and,

Whereas the State has recently developed and adopted stormwater management regulations and marina rules that are tied to the current classification system; and,

Whereas problems with the existing classification system, absence of technical data to support some of the regulations, and lack of staff to expeditiously manage regulatory requirements have resulted in serious problems and objections from coastal landowners and developers; and,

Whereas environmental protection and economic development must co-exist in the coastal region in order that our citizens and our future generations may have a beautiful, healthy, economically stable place to live, work and enjoy; and,

Now, therefore, in consideration of the foregoing, the Legislative Study Commission on Coastal Water Quality hereby endorses the submittal of legislation to the 1986 session of the General Assembly designed to:

1) Adopt a new coastal water quality classification system with an adequate number of categories to clearly differentiate the true "best and existing uses" of our coastal waters,

2) Require that all coastal waters be inventoried for shellfish resources and appropriately classified consistent with the new system mentioned in #1 above. This reclassification effort is to be completed by July 1, 1988,

3) Authorize funding for the Division of Environmental Management to conduct use attainability studies and apply the new classification system,

4) Authorize funding for the Division of Marine Fisheries to conduct an inventory of shellfish resources of the State,

5) Define the term "existing shellfish use" for regulatory purposes so that state agencies can determine if a project violates anti-degradation standards,

6) Require that the appropriate agencies develop and adopt procedures and guidelines for shellfish area closures,

7) Authorize funding for the Division of Environmental Management for a new environmental laboratory with state of the art water quality testing procedures,

8) Evaluate the standards and procedures currently in use to protect water quality and develop improved tests and standards as appropriate,

9) Designate one agency with the responsibility for coastal water quality protection;

10) Authorize additional funding for basinwide water quality studies to identify pollution sources and develop appropriate tools to address them,

11) Evaluate stormwater management alternatives and require that regulations apply consistently throughout the drainage basin. Appropriate stormwater rules should be applied to each of the water quality classifications identified in #1 above,

12) Authorize additional funding for field regulatory staff and require expeditious permit processing in CAMA and DEM,

13) Establish mitigation as an acceptable regulatory tool to offset environmental losses and enhance coastal resources,

14) Authorize funding for a fish hatchery to enhance finfish and shellfish production,

15) Authorize additional funding for the Division of Marine Fisheries for the Shellfish Relocation Program,

16) Authorize additional funding for fisheries research,

17) Define the term "marinas" for regulatory purposes with a differentiation between types of marinas,

18) Establish a regulatory and cost-share program to address water quality cleanup of existing pollution sources with special emphasis on areas adjacent to shellfish resources,

19) Authorize additional funding to continue the Legislative Study Commission on Coastal Water Quality for an additional year.

APPENDIX F

State of North Carolina
Department of Natural Resources and Community Development
512 North Salisbury Street • Raleigh, North Carolina 27611

James G. Martin, Governor

S. Thomas Rhodes, Secretary

November 18, 1986

The Honorable Marc Basnight
The Honorable Margaret Stamey
Members of Coastal Water Quality Legislative Study Commission

Dear Senator Basnight, Representative Stamey, and Members of the Commission:

At your last meeting you requested that the Department of Natural Resources and Community Development prepare its final recommendations for the commission's consideration. Our recommendations include:

(1) the authorization and funding of a reasonable and effective program of protecting sensitive coastal and marine resources. This program would have three components:

   (a) shellfish resource mapping by the Division of Marine Fisheries ($500,000 in 1987-88 and $250,000 in 1988-89);

   (b) water reclassification studies by the Division of Environmental Management ($400,000 in 1987-88 and $300,000 in 1988-89); and

   (c) urban runoff studies by the Division of Environmental Management ($200,000 in 1987-88 and $200,000 in 1988-89).

(2) a legislative recommendation for this department to provide a new definition and permitting review process for marinas.

(3) amendment of 143-214.1 (d) to include a conceptual basis for the classification of coastal waters.

(4) a legislative endorsement of the existing Coastal Stormwater regulations as adopted by the Environmental Management Commission.

PO Box 27687 Raleigh, North Carolina 27611-7687

A list of questions and answers which address the key issues raised during your earlier meetings is enclosed, as is a draft amendment for G.S. 143-214.1 (d).

The Department appreciates the opportunity to respond to your request for more information and is ready to answer any further questions which you might have.

Sincerely,

S. Thomas Rhodes

S. Thomas Rhodes

Enclosure

"DRAFT" LEGISLATION FORM

1. Proposed Statute to be Amended: 143-214.1(d) Water; water quality standards and classifications; duties of the Environmental Management Commission

2. Proposed Change:

The following would be added:

(6) With regard to coastal waters, the factors to be considered shall include historical use for commercial and recreational shellfishing, recreation, fish propagation or multiple uses, the degree to which waters have been closed for specific uses in the past, and the water's potential use in the future including an assessment of the existing impact or potential impact of irretrievable man-induced conditions or potential uses.

3. Reason for change: To provide basic concepts and guidance for the Department of Natural Resources and Community Development and Environmental Management Commission in classifying coastal waters.

4. Fiscal Impact: There will be no specific fiscal impact associated with this change.

5. Other Comments: (such as individual, groups, legislators, etc. who support or oppose the change)

1. Why is there a need to evaluate the current classifications of coastal waters?

All waters of the coastal zone were studied and classified between 1956 and 1963. However, it has recently become apparent that coastal water quality classifications will only be protected if the State expands its efforts to address stormwater runoff and marina development. These new efforts should be balanced by an updating of the classification system.

2. What steps must be followed to reclassify coastal waters?

The Clean Water Act requires the Governor or the State Water Pollution Control Agency (which is the Department of Natural Resources and Community Development in North Carolina) to classify and reclassify all waters of the State.

In order to reclassify coastal waters in a relatively short time frame, the following information is required:

- Identification (mapping) of shellfish resources and areas to be protected.

- Definition of harvestable resources (based on knowledge of existing resources).

- Documentation of bottom substrate characteristics (i.e., where does suitable bottom exist for shellfish to be present?)

- Detailed water quality evaluation of areas marginal for shellfishing.

- Documentation of water pollution sources and efforts required to eliminate/minimize the pollution.

This information will be summarized in use attainability studies. Any proposed reclassification could only be accomplished after appropriate public hearings are held.

3. Why must these steps be followed in reclassifying these coastal waters?

EPA requires a use attainability analysis whenever a change in classification could result in the loss of a presently protected use. EPA must review and approve all reclassifications. If EPA fails to approve the State's proposed reclassification, EPA must impose their own classification for the waters.

4. Who will do the necessary use attainability studies and shellfish mapping?

The Department of Natural Resources and Community Development will do this work. The Division of Environmental Management will do the use attainability studies and the Division of Marine Fisheries will conduct the shellfish mapping.

The Department of Natural Resources and Community Development is committed to the appropriate classification of the coastal waters of North Carolina. Additional resources on the order of $1.85 million over a two year period are needed to properly accomplish this. Shellfish resources areas will be defined as those areas containing a significant shellfish resource or that have shown through historical records to be shellfish producing areas or are considered to have a high potential for shellfish production. A significant shellfish resource will be determined by the Marine Fisheries Commission from data obtained in a directed shellfish bottom survey. Those species considered will be important to commercial and recreational shellfishing interests and will include oysters, hard clams, bay scallops and mussels.

Studies will be conducted concurrently in each of the four Marine Fisheries districts. The surveys will begin in Dare County in the Northern district and in significant shellfish producing areas in the Pamlico, Central and Southern districts. The Division of Marine Fisheries will study bottom types, salinity regimes, shellfish concentrations, areas of present and historical harvest of shellfish and information concerning shellfishing closures. The Division of Environmental Managements studies will include bacteriological data, sediment analysis, water quality sampling and documentation of pollution sources and efforts required to eliminate/minimize the pollution. With the necessary resources to study and implement a modified classifications system, changes can be used to enhance and protect commercial and recreational shellfishing as well as provide for balanced resort/recreational development.

5. What would be included in an appropriate classification of coastal waters?

Two proposals have been put before the Coastal Water Quality Legislative Study Commission, and the proposals both have very strong points. The proposal with five tiers of classifications is very similar to the concept presented by Division of Environmental Management representatives at the first meeting. An appropriate classification should recognize outstanding resource waters, shellfishing waters, primary contact recreational waters and multiple use waters which provide for finfish and shellfish propagation.

6. What legislative action is needed?

(1) The authorization and funding of a reasonable and effective program of protecting sensitive coastal and marine resources. This program would cost $1.85 million over two years and have three components:

(a) shellfish resource mapping by the Division of Marine Fisheries ($500,000 in 1987-88 and $250,000 in 1988-89);

(b) water reclassification studies by the Division of Environmental Management ($400,000 in 1987-88 and $300,000 in 1988-89); and

(c) urban runoff studies by the Division of Environmental Management ($200,000 in 1987-88 and $200,000 in 1988-89).

(2) A legislative recommendation for this department to provide a new definition and permitting review process for marinas. This definition should recognize the number and type of boats, the design of the facility, the type of pollution control measures proposed, and potential for health risks.

(3) The amendment of G.S. 143-214.1 (d) to add the following concepts for a coastal water quality classification system:

"(6) With regard to coastal waters, the factors to be considered shall include historical use for commercial and recreational shellfishing, recreation, fish propagation or multiple uses, the degree to which waters have been closed for specific uses in the past, and the water's potential use in the future including an assessment of the existing impact or potential impact of irretrievable man-induced conditions or potential uses."

(4) A legislative endorsement of the existing coastal stormwater regulations as adopted by the Environmental Management Commission. These regulations have a one year sunset provision and will provide protection from irreversible impacts during this year.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

NOV 18 1986

REF: 4WM/MEB/PV

R. Paul Wilms, Director
Division of Environmental Management
North Carolina Department of Natural
Resources and Community Development
P.O. Box 27687
Raleigh, North Carolina 27611

Re: Water Quality Classification Scheme

Dear Paul:

In your letter of November 7, 1986, you requested that I respond to the implications of adoption of a water quality classification scheme in the North Carolina General Statutes. You indicate in your letter that the proposed classification scheme would have criteria associated with each level of use, but may not provide protection for the swimmable/fishable goals of the Clean Water Act (CWA).

In advising you I feel it would be useful to discuss four specific questions:

1. Are there legal/procedural problems in having the State Legislature adopt classifications/criteria?

Section 303(c)(1) of the CWA authorizes "the Governor of a state or the State Water Pollution Control Agency..." to "hold public hearings (emphasis added) for the purpose of reviewing applicable water quality standards and, as appropriate, modifying and adopting standards A classification scheme adopted by the State Legislature in the manner proposed raises some legal questions on consistency with the CWA. It is also unclear whether the public hearing requirements would have been met.

2. What is required for the State to adopt classifications/criteria that do not achieve the goals of the CWA:

Clearly the Environmental Management Commission in the Department of Natural Resources and Community Development can adopt and revise classifications and criteria for coastal waters. However, whenever the

State designates a classification that does not include uses specified in Section 101(a)(2) of the CWA (propagation of fish, shellfish, and wildlife and recreation), or whenever the State wishes to remove a designated use that is specified in Section 101(a)(2), the State must conduct a use attainability analysis. A use attainability analysis must demonstrate that the use is not feasible for one or more of six limited reasons including natural conditions, human caused conditions which cannot be remedied, and controls which would result in substantial and widespread economic and social impact. (40CFR 131.10)

3. What must EPA do if the State adopts classifications/criteria inconsistent with the goals of the CWA?

If new or revised classifications or criteria are adopted they must be submitted to EPA for approval. If the new classifications or criteria for particular water bodies are not consistent with the goals of the CWA, and if the new classifications are not fully supported by a use attainability analysis, EPA must disapprove the new classifications and criteria and promulgate federal standards to assure compliance with the CWA.

4. How would this impact the NPDES permitting program?

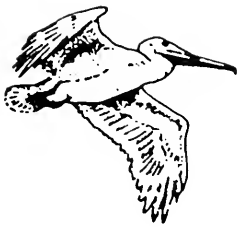
The State Agency that has been delegated NPDES permitting authority must issue permits in compliance with these EPA standards, or EPA could rescind delegation and all NPDES permits in the State would be issued by EPA.

I trust these questions and answers are responsive to the issues raised in your letter. If you would like to discuss this further feel free to contact me.

Sincerely yours,

Bruce R. Barrett, Director
Water Management Division

APPENDIX G



NORTH CAROLINA COASTAL FEDERATION

Route 5, Box 603 (Ocean) • NEWPORT, NORTH CAROLINA 28570 • 919—393-8185

November 14, 1986

Senator Marc Basnight
P.O. Box 1025
Manteo, North Carolina 27954

Representative Margaret Stamey
6201 Arnold Road
Raleigh, North Carolina 26207

Dear Senator Basnight and Representative Stamey:

The North Carolina Coastal Federation commends you on your handling of the Coastal Water Quality Legislative Study Committee. The speakers to date have provided excellent general background information on the current threats to our coastal water resources.

We hope that you will lead the Committee to act diligently on the information that has been presented and to provide the resources necessary to obtain the detailed technical/scientific data needed to manage our important water resources.

The Coastal Federation submits the attached suggested recommendations and explanations for the Committee's consideration in developing their final report. The attachments indicate the key information that we have obtained from the Committee meetings and provide some additional information that should be of value to the Committee.

Please do not hesitate to contact us if we can be of any service.

Sincerely,

Todd Miller

Todd Miller
Executive Director

Attachment

cc: Representative Bruce Ethridge
Emily Johnson

SUGGESTED RECOMMENDATIONS FOR THE

COASTAL WATER QUALITY LEGISLATIVE STUDY COMMITTEE

1. RECOMMENDATION: ENHANCED ENFORCEMENT OF PROGRAMS.

Increased numbers of qualified staff should be provided to implement and enforce existing environmental programs.

EXPLANATION:

Degradation of water quality and loss of habitat are the most significant factors affecting fishery productivity.

Adequate enforcement of existing environmental regulations is the single most important step that can be taken to enhance the fishing industry. Current State programs do not have adquate personnel to protect water quality and habitat. More staff is needed to review permits and, more importantly, to carry out inspections to assure compliance with permit conditions.

Additional personnel would also reduce the time delays in processing permits. These delays are a common source of complaint among permit applicants.

Funds for fishery development will have the greatest, long-term benefit for the most people if spent strengthening the existing environmental programs. Artificial enhancement of fishery productivity will have no sustained value if water quality and habitat cannot support commercial species.

2. RECOMMENDATION: FINE TUNE CLASSIFICATIONS.

The Environmental Management Commission should develop a new water quality classification to fine tune the State's recognition and protection of the uses of the coastal waters. A classification intermediate between the current SA (shellfishing) and SB (swimming) should be considered to provide multiple use waters which do not receive discharges of sewage. This new classification could be called SB "protected" or "SBP."

EXPLANATION:

The four current water quality classifications for marine waters are:

ORW	outstanding resource waters
SA	shellfishing waters
SB	swimming waters
SC	fishing and occasional swimming.

Discharges of sewage are prohibited in SA waters but are allowed in SB and SC waters.

Recently considerable confusion, controversy, and frustration has occurred because people want certain waters to have the quality and assured protection that results from a prohibition on discharges, but they do not have a shellfish resource present and do not want the full water quality protection afforded to shellfish waters. These waters are often adjacent to shellfish waters and are in need of a higher degree of protection than the current SB classification provides.

A new classification would resolve this problem.

New classification schemes have been proposed to the Committee by Ken Stewart of the Alliance for Balanced Coastal Management (ABCM), an organization of developers, and by Ken Kirkman, an attorney for developers. Although these proposed classifications are given different labels, they are essentially the four existing classifications with one or two additional intermediate classifications which prohibit sewage outlets and restrict marinas. Kirkman proposes two new intermediate classifications with basically identical protection measures while the ABCM proposal essentially combines those into one new multi-use classification. These classifications are summarized in the table below.

Current Class.	ABCM	Kirkman	Use
ORW	#1 ORW	#1 CS	Exceptional shellfish or other waters needing maximum protection.
SA	#2 SVW	#2 RS	Commercial and recreational shellfishing
"SBP" (new)	#3 PBC	#3 SP #4 PBW	Swimming and other uses with sewage discharges prohibited.
SB	#4 MUW	#5 PBW	Swimming with sewage discharges allowed.
SC	#5 FPW	#6 RW	Fishing and some swimming with sewage discharges allowed.

Note that Kirkman's proposed #6 classification would have waters that apparently are not suitable for any swimming. This would be counter to the Clean Water Act which requires that all waters be "fishable and swimmable." Thus, his #6 classification has been made equivalent to the current SC classification in the table.

The Environmental Management Commission has authority to adopt new classifications and will likely recognize the need for an intermediate classification. Such a new classification will probably be proposed in the near future and can be initiated by anyone using a petition for adoption of rules (N.C.G.S. 150B-16).

This new classification would not be intended to protect waters for shellfish harvesting. Therefore, reclassification of SA waters to the new classification would be a downgrading which must be justified with a use attainability analysis.

In considering an outline for a classification system, the Environmental Management Commission should have authority to quickly develop new classifications that are found to be necessary. It would be a mistake to require legislative action for all new classifications as that would compound the problem of slow State action that has occurred with the coastal classifications. In most cases, the Commission has the resources to handle classification problems. The recent problems with classifications on the coast have occurred because the Commission did not have the resources to do the field work that needs to be done.

The ABCM and Kirkman proposals go beyond outlining classifications and propose numerical details for implementing the classifications. Such details are better left to be developed by the expertise and procedures existing with the Environmental Management Commission. The reasons for this include:

A. Extensive review and evaluation of technical information is required to properly establish the quantitative criteria. This Committee has not investigated that technical information nor provided adequate public participation to establish such criteria. For example, the most protected classification in North Carolina should have degrees of protection more in line with the Maryland Chesapeake Bay program than the requirements suggested by ABCM. Also, ABCM proposes that a 1 year design storm be used for shellfish waters (#2). After extensive investigations and public discussions, the Environmental Management Commission has found the two year storm to be more appropriate given available information.

   The ABCM proposals are also not consistent with the regulatory framework for protecting water quality. For example, ABCM proposes to require tertiary treatment of sewage in classification #4 and secondary treatment in #5. However, the degree of treatment for discharges must be determined by a case-by-case waste load allocation analysis. Secondary treatment will be inadequate to protect water quality standards in some cases while tertiary treatment may be unnecessarily stringent in other cases.

B. The criteria for protecting water quality should be updated periodically based on new information. The Clean Water Act requires that the State review and update the water quality classification system at least every three years. Detailed criteria fixed in law do not provide the flexibility that is needed to carry out such updates and to manage the public resources.

3. RECOMMENDATION: SHELLFISH RESOURCE IDENTIFICATION

The State of North Carolina should carry out an inventory and mapping of shellfish resources and shellfish areas. The Marine Fisheries Commission should establish a panel of scientific experts to evaluate and refine existing criteria for identifying shellfish areas. The criteria recommended by the panel should be adopted in regulation following the rule-making process. Based on this criteria, the shellfish resources throughout the coast should be mapped. This inventory should determine for each area (a) the existing productivity, (b) the past productivity, and (c) the potential productivity with proper management.

EXPLANATION:

Proper management of the State's fishery resources requires that the amount and location of existing, past, and potential resources be identified. This basic resource inventory is necessary to properly manage shellfish harvesting and to manage environmental alterations that adversely impact the resources.

The criteria used to identify shellfish resource areas is crucial. The most complete, current scientific information available should be used in this criteria. North Carolina is blessed with many scientific experts in fisheries biology and ecology. This valuable scientific resource should be utilized in selecting the criteria. Since the identification of shellfish areas directly affects a wide range of the public, particularly the fisheries and related tourism industries, public awareness and review of the criteria should be provided. The rule making process provides the needed public participation.

4. RECOMMENDATION: USE ATTAINABILITY ANALYSES

Use attainability studies in accordance with federal rquirements should be carried out in conjunction with the resource inventory describe in recommendation 3 above to determine the proper classifications for coastal waters. The entire coast should be done on a priority basis. The highest priority should be shared by key waters which are appropriate to upgrade to outstanding resource classifications and by key waters which are not appropriately classified for shellfishing.

EXPLANATION:

Private and public money is being wasted by legal actions which have the net result of determining whether an area is appropriately classified. It would be more efficient and economical in the long term for the State to carry out the use attainability studies and to reclassify where appropriate to properly implement the water quality protection.

5. RECOMMENDATION: STORMWATER POLLUTION

Stormwater runoff pollution is a very serious threat to water quality, fisheries, and the related tourism industry in North Carolina. State agencies, including the Environmental Management Commission, the Health Services Commission, and the Coastal Resources Commission, should continue to develop adequate, strong controls for stormwater pollution to protect these essential public resources and related industries.

EXPLANATION:

Testimony from the N.C. Division of Environmental Management, the N.C. Division of Health Services, and the U.S. EPA uniformly reported that stormwater pollution was one of the most serious problems for coastal water quality and related industries.

The experience in Pine Knoll Shores, North Carolina shows that even well planned, low to moderate density development can cause closure of shellfish waters due to stormwater pollution. Such low to moderate density development can maintain water quality if carefully managed, but is outside the jurisdiction of the current stormwater program.

Myrtle Beach, South Carolina is spending millions of dollars attempting to clean up stormwater pollution problems which threaten public health and their tourism industry.

The Chesapeake Bay program in Maryland has also found that stormwater pollution is a serious problem. That program determined that a 100 foot buffer area and a limit of 15 percent impervious surface within 1000 feet of the water was needed to protect water quality in areas with low levels of development. Engineering controls were considered to not be sufficiently reliable in these areas. Growth is encouraged to occur in areas that are already intensely developed.

In order to supplement the testimony at the Committee meetings, excerpts of relevant documents are provided as Attachment A. These documents include a report by DEM on "Coastal Development and Shellfish Waters," a memo by Division of Coastal Management staff summarizing some of the available information on the effects of stormwater, and the "North Carolina Barrier Islands Wastewater Management Environmental Impact Statement" by EPA which concluded, among other things, that:

"Degradation of surface water resources by urban runoff is an increasingly serious problem on barrier islands. Development has produced documented negative impacts on shellfish beds bordering several southeastern barrier islands. In some cases these impacts, initially attributed to point source discharges, have been shown to be due to nonpoint sources."

Numerous North Carolina experts in various disciplines have provided comments on the stormwater issue as part of rule-making hearings by the Environmental Management Commission and the Coastal Resources Commission. Like the agencies and States noted above, these experts have concluded that stormwater is a very serious problem and that stringent controls over an area of 1000 feet to half a mile from surface waters is needed. Copies of comments from North Carolina experts in marine biology, public health, and environmental engineering are provided as Attachment B to further supplement the information provided to the Committee.

6. RECOMMENDATION: SEPTIC TANKS.

Improperly sited septic tanks significantly contribute to pollution of coastal waters, particularly shellfish waters. Increased State oversight of local septic tank permit programs and greater opportunity for public scrutiny of septic tank permits is recommended to reduce the problem of improper issuance of septic tank permits. Also, the current requirement for a separation between the nitrification field and the groundwater table is not adequate to protect shellfish waters. An appropriate separation for shellfish water should be developed.

EXPLANATION:

Several Committee members and speakers noted that improperly sited septic tanks are a serious problem in coastal counties. The improper siting is due to two causes:

1. Under current practices, local public health departments sometimes cannot withstand the local political pressure to issue permit for unsuitable sites. Local public health personnel may have their jobs jeopardized if they properly enforce the State regulations.

   Increased State oversight of local programs would help reduce this problem. A specific program of State review of a portion of the permits issued by local health departments would let the local personnel and those attempting to influence them know that improper permits could be caught and would result in stiff enforcement actions. Additional staff in the Division of Health Services would be needed for such a program.

   In addition, the most effective means of reducing political influence in environmental decision (and in line with the principles of democracy) is to have an opportunity for public scrutiny of the agency's actions. Public notice of applications for permits would allow the public to more carefully observe the actions of the local health departments and respond to any impropriety.

2. The current North Carolina regulations allow septic tanks to be located at sites with only one foot of separation between the nitrification field and the water table. Recent studies have shown that this distance in not adequate to protect adjacent shellfish waters. A summary of some of the recent research is provided as Attachment C (obtained from the "North Carolina Barrier Islands Wastewater Management

Environmental Impact Statement").

More appropriate separations are needed for septic tanks near shellfish waters.

7. RECOMMENDATION: NUMERICAL NUTRIENT STANDARDS.

In order to force discharges in the State of Virginia to protect water quality in North Carolina, numerical water quality standards for nutrients should be adopted for the Chowan River Basin.

EXPLANATION:

Committee members and speakers stated that discharges of nutrients in Virginia were very significant causes of pollution to the Chowan River Basin in North Carolina. The State has been unable to make Virginia control these discharges.

EPA and the North Carolina Division of Environmental Management both testified that the state of Viriginia would be required to protect water quality in discharges to waters flowing to North Carolina if numerical standards for nutrients were adopted for the Chowan River Basin. Such standards should be adopted.

ATTACHMENT A

ATTACHMENT A

Coastal Development and Shellfish Waters

APRIL 1985

Division of Environmental Management

CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT

REPORT No. 85-05

INTRODUCTION

North Carolina's coastal areas are rapidly being developed, and the impacts of this development are reflected in the declining quality of our coastal waters. The results of a recent study by Drs. Maiolo and Tschetter at East Carolina University suggest a correlation between the population increase in nine coastal counties and the acres of estuarine waters closed to shellfishing from 1950 to 1980 (Maiolo and Tschetter, 1984). Both point source and non-point source pollution contribute to degraded water quality in shellfish areas.

The North Carolina Division of Environmental Management has a permit program to regulate the discharge of pollutants into these coastal waters from point sources. Discharges from point sources into SA waters are addressed in the State's classification and water quality standards (15 NCAC 2B .0212C 3{B}+{C}). This regulation prohibits the discharge of any sewage into SA waters. The standard for SA waters for fecal coliform is a median of 14/100 ml, with no more than 10 percent of the samples exceeding 43/100 ml. No mixing zone for fecal coliform organisms is allowed in SA waters and the standard applies during the most unfavorable hydrographic and pollution conditions. Dischargers existing prior to the classification of the waters as SA are prohibited from expanding their facilities. In addition to protecting SA waters from sewage pollution, this classification prohibits the discharge of industrial wastes that are not treated to the satisfaction of the Environmental Management Commission (in accordance with the requirements of the Division of Health Services).

While a comprehensive program is in place to address point sources discharges into SA waters, no program exists to address non-point source discharges into these waters. Significant levels of contaminants have been attributed to several nonpoint sources in coastal areas. As coastal development continues, urban runoff will increasingly affect water quality. High density development with large areas of impervious cover will produce larger runoff volumes with associated pollutant loads. The discharge of sewage wastes from boats and runoff from development around marinas is also degrading water quality. The failing of septic tanks due to improper siting and/or construction has led to the closure of shellfish waters in several areas along the North Carolina coast. Mitigation practices will be needed to address all of these pollution sources if coastal shellfish resources are to be protected.

URBAN STORMWATER RUNOFF

Constituents of Urban Stormwater Runoff

Numerous studies conducted over the last 15 years have documented the pollution potential of stormwater runoff from urban areas (Sartor and Boyd 1972, Bryan 1970, NRCD-DEM, 1983). The most exhaustive effort, funded by the U.S. EPA, was the Nationwide Urban Runoff Program (NURP) (U.S. EPA 1983a).

This program sponsored comprehensive field studies in 28 cities located nationwide, including Winston-Salem, North Carolina; Myrtle Beach, South Carolina; and Long Island, New York; which are particularly pertinent to this report and will be discussed in more detail later.

These NURP studies have not only measured the types and quantities of pollutants contained in urban runoff, but have also evaluated receiving water quality and biological impacts caused by these runoff constituents. The effectiveness and cost of a wide variety of runoff pollution control measures has also been considered by NURP and other studies (NRCD-DEM 1979, Colston 1974, Field et al. 1977, and Amy et al. 1974). In addition, desk-top and complex computer models have been developed by federal, state and local agencies, as well as private and academic research institutions, which predict the quantity and quality of urban stormwater runoff and its effect on receiving waters (Huber et al. 1975, Proctor and Redfern 1976 and 1976a, U.S. Army Corps of Eng. 1977).

Pollutant types in urban runoff and their predominant sources are summarized in Table 1. It is quite clear that all pollutant categories are prevalent in runoff from all major urban land use types and that the sources of these pollutants are quite diverse. Loading rates which can be expected as a result of stormwater washoff of these pollutants are summarized in Table 2 as a function of urban land use categories. EPA recommends the use of these numbers for planning purposes. Extensive statistical analysis of these data did not show any regional or geographical trends or relationships, hence the numbers should be valid on a nationwide basis. Similarly, the "typical" quality of runoff waters, based on data collected by NURP is shown in Table 3.

Indicator Bacteria and Pathogens in Urban Runoff

Although all pollutant types in runoff are of importance in coastal North Carolina, microorganisms are the most immediate and apparent concern for shellfish waters. They are of particular

importance because oysters and clams are known to concentrate viruses, and hepatitis outbreaks have been traced to consumption of virus-contaminated shellfish (Long Island Regional Planning Board 1982, pg. C-7). As a result, the North Carolina Division of Health Services recommends closure of waters to shellfishing when median levels of the indicator organism, fecal coliform, exceed 14 organisms per 100 ml (MPN, Method A.1). Fecal coliform bacteria are not pathogenic, but are derived from the intestines of warm-blooded animals and have long been used by public health and pollution control agencies as indicators of the likely presence of pathogens.

Data collected by NURP (Table 4) demonstrates that high concentrations of total and fecal coliforms are contained in urban runoff. These coliforms can be derived from human sources such as combined sewer overflows, septic tank leachates (under high water table conditions), and illicit sanitary connections to storm sewers. Several studies have also shown the source of high numbers of coliforms in runoff from impervious surfaces (roads and parking lots) to be animals such as rodents, dogs, cats, birds, and livestock in carrier vehicles (Moore, Gardner and Assoc., Inc. 1979, Long Island Regional Planning Board 1982, Olivieri et al. 1977, and Gupta et al. 1981). The source of indicator bacteria is usually determined by the relative numbers of fecal coliform (FC) to fecal streptococcus (FS) organisms. An FC/FS ratio of less than 0.7 suggests that the bacterial source is non-human, while a ratio greater than 4.0 implicates human sources (a ratio between 0.7 and 4.0 allows no conclusions to be drawn)(Geildreich and Kenner 1969).

The presence of human pathogens (bacteria and viruses) in separate stormwater has been confirmed in two studies (Olivieri et al. 1977 and Long Island Regional Planning Board 1982). Both studies found relatively low concentrations of these pathogens compared to levels normally found in raw sewage. Although little is known about the density of various pathogens required to cause human infection, it is known that theoretically only a single virus is sufficient. Since shellfish are known to concentrate viruses, the danger from consumption of raw or partially cooked shellfish is particularly serious.

It is important to keep in mind that questions of pathogen occurrence and quantifiable human health hazard with respect to stormwater and shellfish are for the present, and the forseeable future, largely academic. The use of coliforms as indicators, and their incorporation into water quality standards, is based on the fact that pathogen determinations are complicated, tedious, time consuming, and consequently subject to more uncertainty than coliform determinations which are simple, quick, and accurate (Long Island Regional Planning Board, 1982). Achieving good quality control across the spectrum of public and private laboratories which would be performing pathogen determinations would be extremely difficult. As such, the administrative convenience of the coliform determination is a compelling reason

for its present and continued use.

Field Documentation of Stormwater Runoff Impacts on Shellfish Waters

One of the most comprehensive programs to evaluate effects of urban stormwater discharges on shellfish waters was done by the Long Island Planning Board (1982). This work was begun under EPA's 208 program and was continued under NURP (U.S.EPA 1983a). As shown in Table 5, fecal coliform concentrations in the runoff samples were often very high (greater than 2000/100 ml in two-thirds of the samples), and Salmonella pathogens were detected in one-third of the samples. In stream and estuary samples, fecal coliform counts exceeded 2000/100 ml in about 30% of the samples while Salmonella were detected in 3-5% of the samples.

This study also found that well over 90% of the coliform loading to Long Island bays was derived from separate stormwater runoff (illustrated in Table 6 for Suffolk Co.). This has resulted in closure of major segments of Long Island's shellfish waters, especially those along the South Shore. Table 7 summarizes these South Shore shellfish area closures. Note that 73.5 percent of the shellfish waters in Nassau County are closed, 13.8% in Suffolk, with an overall South Shore closure of 21.3%. The density of development in Nassau County is considerably higher than most of Suffolk County. Nassau County shares its western county line with New York City. The annual commercial shellfish harvest along the South Shore was valued at $17.5 million.

Based on fecal coliform to streptococcus ratios, the coliform loadings were traced to non-human sources. The fecal coliform loading rates for a 73 acre medium density residential area (20% impervious cover, average lot size of 7500 sq. ft.) varied from 4.5×10^7 to 9.7×10^9 organisms per acre per inch of rainfall.

Another intensive field monitoring effort in a coastal area was carried out under both the 208 and NURP programs in northeastern South Carolina at Myrtle Beach (Moore, Gardner and Assoc. 1979). One of the major issues which prompted the Myrtle Beach studies was public health concern over direct stormwater runoff discharge to Grand Strand beaches. Early studies had identified 289 separate and distinct stormwater pipes discharging directly onto beaches within the city limits, and 120 were selected for sampling. In the Myrtle Beach area most beach discharges are derived from areas only several blocks wide along the Grand Strand. As was shown in Table 4, these storm sewer discharges had high geometric mean fecal coliform levels, especially for the commercial district.

In a follow-up study, bacterial data were also collected from the surf, eroded areas between sewer outfalls and the surf ("pipe streams"), and natural beach pools, all of which were influenced

by the runoff from the same commercial district listed in Table 4. Data summaries for each of these sample sources compared to State of South Carolina Standards are given in Tables 8 and 9. Note that shellfish waters do not exist in the Myrtle Beach area and the SA standards are used for comparative purposes only. These data demonstrate that standards for both shellfish protection (SA) and frequent body contact, i.e. swimming (SB) are frequently violated as a result of stormwater discharges. Though standards were frequently violated in the surf, the major public health concern was related to direct body contact with stormwater discharges in pipe streams.

It was also concluded in this study that the major source of coliforms in stormwater samples was accumulation on impervious surfaces; street samples collected during peak tourist season revealed very high coliform counts. Based on fecal coliform/fecal streptococcus (FC/FS) ratios, nonhuman sources were implicated much more frequently than human sources for wet weather generated coliforms for this Myrtle Beach commercial district.

Another comprehensive field study of stormwater impacts on shellfish waters was recently done at Hilton Head Island, South Carolina (Applied Biology, Inc. 1984). Substantial oyster growing areas in Lawton Creek, Broad Creek, and Point Comfort Creek have been closed to shellfishing due to high coliform levels. Previous studies had suggested that coliform levels increased during rainfall events, implicating nonpoint sources, but fecal coliform to fecal streptococcus ratios suggested that these bacteria were derived from human sources. As a result, a detailed study to define the sources of coliforms, and recommend a means of abatement, was undertaken. Intensive monitoring of one watershed (Lawton Canal) revealed three predominant sources of bacterial contamination:

1. Illicit sanitary waste discharges from two private clubs;

2. Manure from a riding stable; and

3. Septic tanks.

Although this study did not implicate coliform washoff from impervious surfaces as the major source in the watershed investigated, it provided useful insight into nonpoint loadings in highly developed urban areas. As has been shown in other urban runoff studies, it is extemely difficult, if not impossible, to prevent all sanitary sewage inputs to stormwater systems in highly developed areas. The obvious inference is that stormwater control practices will not only mitigate contamination from non-human sources, but they also provide some degree of protection from uncontrollable human sanitary sources.

Mitigation Practices

There are several general types of practices which can be used to mitigate the effects of urban runoff pollution. As summarized by the NURP project four of these are:

1. Detention devices such as dry and wet detention basins, over-sized drain pipes and catchbasins;

2. Recharge devices such as infiltration pits, trenches and ponds, open-bottom galleries and catchbasins and porous pavements;

3. Housekeeping practices such as street sweeping, sidewalk cleaning, litter containers, catchbasin cleaning, pet waste cleanup ordinances, etc.; and

4. Other non-structural treatment methods such as grassed swales and wetland filtering.

Except for housekeeping practices, these mitigation measures are most effective for new urban developments.

The U.S. EPA has also channeled considerable funding over the last decade into research and development projects designed to evaluate structural treatment systems for urban runoff and combined sewer overflows. These include such devices and processes as swirl concentrators, dissolved-air flotation, contact stabilization, sedimentation, screening and high-rate disinfection. This type of treatment is costly, and the research was intended to address pollution abatement in existing urban areas where water quality impacts are severe (Field et al. 1977, NRCD-DEM 1979).

The determination of effectiveness and cost of stormwater management practices which are technically and institutionally feasible on the local level was one of the main objectives of NURP. Figure 1 shows the costs and total suspended solids (TSS) removal effectiveness for wet detention basins as a function of detention basin size. Note that basins designed with surface area only 0.5 to 1.0% of the urban drainage area will remove 80-95% of the TSS and that the larger the size of the development, the lower the unit cost. The Long Island NURP study showed that wet detention basins are also capable of significant coliform reduction (more than 90% overall reduction of total and fecal coliforms and fecal streptococcus). Given the high levels of coliforms in untreated runoff (Table 4) even a 90% reduction as a result of passage through a detention basin might not be sufficient to prevent water quality violations in poorly flushed estuarine areas.

Recharge devices were also found by NURP to be a highly effective means of runoff pollution abatement with no apparent degradation of groundwater quality. The most extensive study of groundwater recharge basins was made in the Long Island program.

Table 1. Listing of Common Contaminants in Urban Runoff.

CLASSIFICATION	EXAMPLES	PRIMARY SOURCES
Particulates	Dust and dirt, stones, sand, gravel, grain, glass, plastics, metals, fine residue, etc.	Pavement wear, vehicle wear, atmospheric washout, litter, winter sand application.
Heavy Metals	Lead, zinc, iron, copper, cadmium, nickel, chromium, mercury, and manganese.	Vehicle wear and emission, atmospheric washout, fuel combustion.
PCB, Pesticides	Chlorinated hydrocarbons, organo-phosphorus.	Atmospheric washout and pesticide use on lawns, gardens, and highway right-of-way.
Inorganic Salts	$CaCl_2$, NaCl, SO_4, Br.	Dicing salts, atmospheric washout, and vehicle emissions.
Organic Matter	Vegetation, dust and dirt, humus, roadway accumulations, oil, fuels, PAH and other combustion products.	Roadside vegetation and leaves, vehicle wear, litter, animal wastes, and combustion products.
Microorganisms	Coliforms, pathogenic bacteria (Shigella spp., Salmonella spp., etc.) and viruses.	Soil, litter, excreta (human and non-human; eg. birds, rodents, cats, dogs, etc.).
Other	Asbestos, rubber, special compounds.	Vehicle wear and specific fuel additives.

Table 2. Annual Urban Runoff Loads KG/HA/YEAR (US EPA 1983a)

Constituent	Site Mean Con. mg/l	Residential	Commercial	All Urban
Assumed Rv		0.3	0.8	0.35
TSS	180	550	1460	640
BOD	12	36	98	43
COD	82	250	666	292
Total P	0.42	1.3	3.4	1.5
Sol. P	0.15	0.5	1.2	0.5
TKN	1.90	5.8	15.4	6.6
NO_{2+3}-N	0.86	2.6	7.0	3.6
Tot. Cu	0.043	0.13	0.35	0.15
Tot. Pb	0.182	0.55	1.48	0.65
Tot. Zn	0.202	0.62	1.64	0.72

Note: Assumes 40 inches/year rainfall as a long-term average.
Rv = ratio of runoff to rainfall volume.

Table 3. Water Quality Characteristics of Urban Runoff (US EPA 1983a).

Constituent	Median EMC[a]
TSS (mg/l)	100
BOD (mg/l)	9
COD (mg/l)	65
Tot. P (mg/l)	0.33
Sol. P (mg/l)	0.12
TKN (mg/l)	1.50
NO_{2+3}-N (mg/l)	0.68
Tot. Cu (ug/l)	34
Tot. Pb (ug/l)	144
Tot. Zn (ug/l)	160

[a]EMC = event mean concentration; event to event variability in EMC's (expressed as the coefficient of variation) ranged from 0.5 to 1.0 for all constituents except TSS, which ranged from 1.0 to 2.0.

Table 4. Fecal Coliform Concentrations in Urban Runoff.

Data Source[a]	Warm Weather		Cold Weather	
	Median EMC[b]	No. Observations	Median EMC[b]	No. Observations
Winston-Salem, NC				
-Central Business District	15,000	11	1,000	8
-Residential Area	23,000	2	2,600	4
Myrtle Beach, SC				
-Residential	630[c]	6	---	---
-Commercial	3,500[c]	165	---	---
-Mixed Res./Comm.	680[c]	18	---	---
Long Island, NY				
-Residential	24,000	12	1,400	15
-Mixed Res./Comm.	11,000	7	900	4
Eleven NURP Sites[d]	21,000	11	1,000	9

a. NC, NY and NURP data from US EPA, 1983; SC data from Moore, Gardner and Assoc., 1979.
b. EMC - Median value of all flow weighted mean concentrations from each event; organisms/100 ml.
c. Geometric mean value for specified number of samples.
d. Median of site median EMC's for specified no. of sites.

Table 5. Comparison of the Frequency of Detection of Salmonella with Levels of Fecal Coliforms (Long Island Regional Planning Board 1982).

Sample Source	Fecal Coliforms Range MPN/100 ml	Fecal Coliforms No. of Samples in Range	Salmonella Number Positive	Salmonella % Positive Findings	Range of Salmonella Org. (MPN/10L)
Sewage	0-200	1	0	0	-
	201-2,000	1	0	0	-
	2,001-20,000	0	0	0	-
	>20,000	14	12	86	-
	Overall	16	12	75	360-24,000
Storm Water Runoff	0-200	1	0	0	-
	201-2,000	12	5	42	-
	2,001-20,000	17	5	29	-
	>20,000	10	3	30	-
	Overall	40	13	33	3-23
Pond Effluents	0-200	75	2	3	-
	201-2,000	67	9	13	-
	2,001-20,000	36	3	8	-
	>20,000	8	2	25	-
	Overall	186	16	9	3-122
Streams	0-200	15	1	7	-
	201-2,000	36	1	3	-
	2,001-20,000	29	1	4	-
	>20,000	4	1	25	-
	Overall	84	4	5	3.6-9
Estuarine	0-200	23	1	4	-
	201-2,000	11	0	0	-
	2,001-20,000	4	0	0	-
	>20,000	0	0	0	-
	Overall	38	1	3	9.1

Table 6. Suffolk County Relative Contribution of Total and Fecal Coliform from Runoff, Stream Base Flow, and Point Sources to Surface Water (Long Island Regional Planning Board, 1982).

Receiving Water	Total Coliform				Fecal Coliform			
	MPN/YR Total	Percent of Annual Load			MPN/YR Total	Percent of Annual Load		
		Runoff	Streams	Point Source		Runoff	Streams	Point Sourc
Western Great South Bay*	4.6×10^{16}	98	2	NA	7.1×10^{15}	98	2	NA
Eastern Great South Bay	9.5×10^{15}	94	5	1	1.6×10^{15}	93	6	1
Moriches Bay	3.1×10^{15}	97	2	1	5.2×10^{14}	96	2	2
Shinnecock Bay	1.6×10^{15}	100	0	NA	2.6×10^{14}	100	0	NA
Peconic River/Flanders Bay	6.7×10^{14}	97	1	2	1.2×10^{14}	96	1	3
Mount Sinai Harbor	4.1×10^{14}	100	NA	NA	6.7×10^{13}	100	NA	NA
Port Jefferson Harbor	2.7×10^{15}	99	0	1	4.4×10^{14}	99	0	1
Stony Brook Harbor	1.5×10^{15}	100	NA	NA	2.6×10^{14}	100	NA	NA
Nissequogue River/Smithtown Bay	4.4×10^{15}	98	1	1	7.2×10^{14}	98	1	1
Huntington Bay/Northport Harbor	1.7×10^{16}	98	0	2	2.7×10^{15}	98	0	2

NA - Not Applicable

Table 7. Shellfish Water Closures in South Shore Region of Long Island, NY (Long Island Regional Planning Board, 1982).

County	Acreage		Percent Closed
	Total Designated for Shellfishing(SA)	Open	
Nassau	12,345	3,271	73.5
Suffolk	85,730	73,910	13.8
Total	98,075	77,181	21.3

Table 8. Myrtle Beach, SC Stormwater Study - Surf Data
(Moore, Gardner and Assoc. 1979).

Weather Condition	Class SA[a]			Class SB[b]		
	Median	Percentage >230/100 ml	Standard Violation	Geometric Mean	Percentage >400/100 ml	Standard Violation
Dry	27 (TC MPN/100 ml 53 Samples)	23%	Yes	13 (FC MPN/100 ml 40 Samples)	5%	No
Wet	790 (TC MPN/100 ml 216 Samples)	75%	Yes	250 (FC MPN/100 ml 146 Samples)	36%	Yes
Wet & Dry	490 (TC MPN/100 ml 269 Samples)	65%	Yes	133 FC MPN/100 ml 186 Samples)	28%	Yes

(a) Class SA - Median Total Coliform of 70/100 ml or less and 10% of Samples not to exceed MPN of 230/100 ml.

(b) Class SB - Fecal Coliform Geometric Mean of 200/100 ml or less and 10% of Samples in any 30-Day period not to exceed 400/100 ml.

Table 9. Myrtle Beach, SC Stormwater Study - Pipe Stream and Natural Beach Pool Data(a) (Moore, Gardner and Assoc., 1979).

	Class A(b)			Class B(c)		
	Geometric Mean	Percentage >400/100 ml	Criteria Exceeded	Geometric Mean	Percentage >2000/ml	Criteria Exceeded
Weather Condition		Pipe Streams				
Dry	20,000 (FC MF/100 ml 1 Sample)	100%	Yes	20,000 (FC MF/100 ml 1 Sample)	100%	Yes
Wet	24,666 (FC MF/100 ml 28 Samples)	93%	Yes	24,666 (FC MF/100 ml 28 Samples)	82%	Yes
Wet & Dry	24,488 (FC MF/100 ml 29 Samples)	93%	Yes	24,488 (FC MF/100 ml 29 Samples)	83%	Yes
Weather Condition		Natural Beach Pools				
Dry	58 (FC MF/100 ml 9 Samples)	33%	Yes	58 (FC MF/100 ml 9 Samples)	11%	No
Wet	2,570 (FC MF/100 ml 11 Samples)	82%	Yes	2,570 (FC MF/100 ml 11 Samples)	45%	Yes
Wet & Dry	468 (FC MF/100 ml 20 Samples)	60%	Yes	468 (FC MF/100 ml 20 Samples)	30%	Yes

(a) Direct beach discharges flowing across or ponding on the beach are not classified by the South Carolina Department of Health and Environmental Control and consequently state water quality standards are for comparative purposes only.

(b) Class A - Fecal coliform geometric mean of 200/100 ml or less and 10% of samples in any 30 day period not to exceed 400/100 ml.

(c) Class B - Fecal coliform geometric mean of 1000/100 ml or less in any 30 day period and 20% of samples not to exceed 2000/100 ml in such period (not applicable during or following periods of rainfall).

State of North Carolina
Department of Natural Resources and Community Development
Division of Coastal Management
512 North Salisbury Street • Raleigh, North Carolina 27611

James G. Martin, Governor
S. Thomas Rhodes, Secretary

David W. O
Dir

August 28, 1985

MEMORANDUM

TO: COASTAL RESOURCES COMMISSION

FROM: Melissa McCullough

RE: Urban Runoff Impacts and Management Strategies

In recent years we have seen North Carolina's coastal water quality declining, our fisheries resource suffering, our shellfish resources being closed because of bacterial contamination and our coastal rivers green and clogging with algae. McCullough (1984) described a declining water quality trend almost coastwide -- especially due to non-point sources and all under current NC regulations. It is evident that existing regulations are not adequately protecting our fragile estuarine waters from the activities taking place adjacent to them.

Consequent to a CRC Water Quality Task Force investigation into the CAMA mandate to preserve and enhance water quality and a CRAC Roundtable series for coastal residents on water quality, the CRC planned a water quality initiative to address water quality problems of highest concern to the North Carolina coast. The water quality issue to be addressed first was urban runoff. The recent availability of the EPA Nationwide Urban Runoff Program (NURP) results, Chesapeake Bay-related research and extensive other urban and stormwater runoff studies' results, as well as feedback from other states about the efficacy of their programs, provided a firm informational base from which to develop the proposed runoff management strategy.

This report will attempt to characterize urban runoff, its impacts and land use origins. Various runoff controls will then be described and their advantages and disadvantages explained — especially with respect to the coastal situation in North Carolina. Finally, the proposed regulations will be outlined and the rationale for their selection

detailed.

In a normal hydrological cycle, rainfall water divides into four general "compartments". In an undisturbed watershed, evapotranspiration -- that which is taken up by vegetation in transpiration and which evaporates from land and plant surfaces and returns to the atmosphere -- accounts for 40% of the rainfall. Deep infiltration and shallow infiltration each account for 25% of the rainfall. Some of the shallow infiltration will also recharge surface waters. Only 10% runs off to nearby creeks, streams and lakes.

In a developing watershead, impervious surfaces -- pavement and buildings - cover soils and destroy vegetation that would normally slow and absorb runoff. Figure 1 illustrates the effect of increased impervious surfaces on the volume distribution of water to the four "compartments". The increased runoff is caused by the quick removal of rainwater from paved

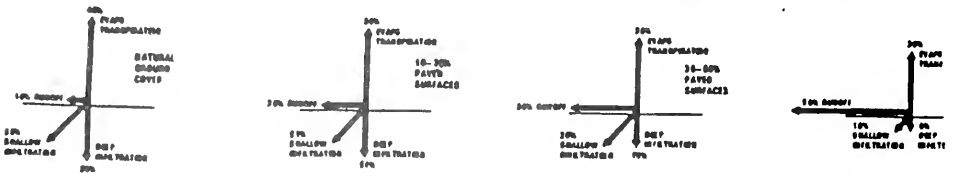


Figure 1. Typical Changes in Runoff Flows Resulting from Paved Surfaces

surfaces allowing less evaporation, less vegetation transpiring, and less soil area for infilteration. Several literature reviews verify that the volume of runoff increases significantly with the percentage of impervious surface (US EPA, 1983; Klein, 1979, 1985; Metro. Wash. COG, 1979). The diversion of water from infiltration to runoff has obvious hydrological impacts, such as decreasing dry weather stream baseflow, non-recharge of groundwater, increasing the severity and frequency of flooding and increasing channel erosion (Klein, 1979, 1985).

The increase in stormwater runoff volumes into surface water bodies has a number of impacts. In North Carolina estuaries, slugs of freshwater can act as pollutants, impacting marine organisms using the estuaries as reproduction and growth habitat (Pate and Jones, 1981). But the increased runoff due to impervious cover also carries a significant increase in pollutant inputs, such as sediments, nutrients, bacteria and toxics (Klein, 1979; EPA, 1983; Long Island, 1982; Metro. Wash. COG, 1979; Waccamaw Reg. P.D.C., 1972; Hartigan, 1985).

Klein (1985) cited eight reports which likened urban runoff to raw sewage or secondary treatment plant effluent in terms of pollutant content. The final NURP report (EPA, 1983) made the same comparison after calculating loads for several pollutants. The NURP report gives a general characterization of the water quality of urban runoff, obtained by pooling the site data from all sites, which they feel is appropriate for planning purposes. Pollutant concentrations are given as EMC (event mean concentration - the average of all sample measures taken for the

duration of any one storm event) in Table 1 and compared to North Carolina water quality standards of SA waters. It is important to note that most pollutant measures are given in concentration, which is not sensitive to

Constituent	Event to Event Variability in EMC's (Coef Var)	Site Median EMC		NC Tidal Saltwater Standards
		For Median Urban Site	For 90th Percentile Urban Site	
TSS (mg/l)	1-2	100	300	
BOD (mg/l)	0.5-1.0	9	15	-
COD (mg/l)	0.5-1.0	65	140	-
Tot. P (mg/l)	0.5-1.0	0.33	0.70	-
Sol. P (mg/l)	0.5-1.0	0.12	0.21	-
TKN (mg/l)	0.5-1.0	1.50	3.30	-
NO_{2+3}-N (mg/l)	0.5-1.0	0.68	1.75	-
Tot. Cu (ug/l)	0.5-1.0	34	93	10
Tot. Pb (ug/l)	0.5-1.0	144	350	25
Tot. Zn (ug/l)	0.5-1.0	160	500	50

Table 1. Water Quality Characteristics of Urban Runoff and NC Standards

runoff volume. However, total loads of pollutants are strongly influenced by runoff volume. (US EPA 1983).

The pollutants carried by stormwater are in two fractions -- settleable and dissolved. Pitt and Bozeman (1980) report that most pollutants in urban runoff are soluble and remain available in the water column. Among those pollutants expected to be attached to particulates (especially of very small size) are 95% of lead (Pitt and Bozeman, 1980), 83-96% of petroleum hydrocarbons (Ammon and Field, 1980; Klein, 1985), 25% of BOD (biochemical oxygen demand), 33-50% of nutrients, 50% of metals and 75% of pesticides (Klein, 1985).

Inert sediments themselves are not a significant urban runoff pollutant except in construction phases when sediments can cause increased turbidity, change bottom sediment composition and bury benthic (bottom-dwelling) organisms (Klein, 1985). An urbanizing watershed generally loses nine times as much sediment as a rural one. An acre under construction may erode 20,000-40,000 times the amount from an acre of farm or woodland (Klein, 1979).

Pollutants which are sorbed to settleable solids are a significant urban runoff problem. The solids can settle to estuarine bottoms where they are available to benthic fish, shellfish and a multitude of lower food chain organisms. Substances bound to sediments can be released (Klein, 1985) through biological decomposition (as by microbial action or ingestion by benthic invertebrates) or when subjected to higher acid environments (such as the PH gradient from river to estuary). Substances may also

accumulate in the sediments. Comparisons of stream bottom sediments showed concentrations of lead in urban streams ten times as high as rural, arsenic nine times as high, BOD 4.4 times as high, ortho-phosphorus 4.4 times as high, sulfate 33-60 times as high and high molecular weight hydrocarbons significantly higher (Field and Turkletaub, 1980; Pitt and Bozeman, 1980). A similar study of heavy metals in North Carolina showed aluminum in urban stream sediments 13-24 times as high as in rural, chromium up to three times as high and lead 5-20 times as high (Klein, 1985).

To convey an understanding of the implications of these pollutants' presence in North Carolina waters, this report will briefly describe some studies' results on various pollutants.

Bacterial contamination is a significant problem in North Carolina now because it has resulted in the closure of a significant portion of North Carolina waters to shellfishing — over 30% in three of the six major estuarine systems (NC DEM, 1984). An EPA survey at Myrtle Beach, SC recorded concentrations of fecal coliforms (an indicator for pathogens) from urban runoff of 200-163,000 MPN per 100 ml; a mean without extreme values of 600 per 100 ml (Waccamaw, 1977). (The US FDA standard is a median of 14 MPN per 100 ml, 10% not to exceed 43). The final NURP report (US EPA, 1983) described a median fecal coliform EMC of 21,000 in warm weather urban runoff, 1,000 in cold weather.

There is some argument taking place as to how effective fecal coliforms are as indicators of pathogen contamination. The Long Island NURP (1982) felt their fecal coliform/fecal streptococcus ratio was not conclusive as to whether the bacteria were a human or animal origin. Quereshi and Dutka (1979) tested three urban sites (two residential, one commercial) and found bacteria of predominantly non-human origin — but 1/3 of the samples contained pathogens as well. The authors felt a health risk existed. Klein (1982) in his research review concluded that pathogens found in urban runoff may cause potential health problems resulting from body contact with urban streams. Since the studies were of streams, shellfish impacts could not be considered. However, the Long Island NURP (1982) report examined and confirmed that urban runoff sources of bacteria were the principle contributors to the water column concentrations that resulted in closure of shellfish beds in a number of embayments. So, while current literature suggests that indicators such as fecal coliforms may not be useful in identifying health risks from urban runoff pollutants (US EPA, 1983), two facts remain. First, that pathogens are found in urban runoff and, second, that those levels of fecal coliforms found in urban runoff can contaminate shellfish beds at levels exceeding the US FDA standard.

Nutrient enrichment is another major problem on the North Carolina coast. The eutrophication problem, demonstrated as increased algae blooms in coastal river systems, has showed a trend of worsening (McCullough, 1984). Though the NURP report (US EPA, 1983) opined that no general

assessment of eutrophication by urban runoff could yet be made, they recognized that specific situations have been identified where urban runoff is a significant contributor. Klein (1985) found that watershed urbanization had caused loadings of nitrogen and phosphorus to increase by 33% and 110%, respectively. The majority of nutrients emanating from residential land uses, also, are in a dissolved, more available form (Klein, 1985; Metro. Wash. COG, 1979). Klein (1979) related that mean total nitrogen exports from urban areas were second only to intensely farmed watersheds, phosphorus second only to cleared, unproductive land.

Related to the nutrient problem is that of oxygen-demanding (BOD) materials, such as organic matter, that decays and depletes dissolved oxygen (DO) in the water -- severe episodes ending in fish kills. The BOD content in urban runoff, equivalent to that in secondary wastewater effluent (Field and Turkletaub, 1980), contributes about 45% of the annual load of oxygen-demanding material (Ammon and Field, 1980) and is sufficient to cause low DO problems in receiving waters (Klein, 1985).

Toxic substances are the other major pollutant category of concern for North Carolina -- toxics such as heavy metals (lead, chromium, cadmium, etc.), petroleum hydrocarbons, pesticides (weed killers, insecticides) and other substances emanating from vehicles and urban chemical uses. The final NURP report (US EPA, 1983) described toxic metals as by far the most prevalent EPA priority pollutant constituent of urban runoff. Those detected most often were copper, lead and zinc -- all were found in at least 90% of the samples, were the most geographically well-distributed, and were found with the highest concentrations for any pollutant (reaching maximum concentrations of 100, 460 and 2400 mg/l respectively). A number of independent studies also found metals at much higher concentrations than background, expecially for shockload discharges, and at concentrations high enough to impact aquatic life (some with maximums 10 times higher than the recommended criteria for aquatic or marine life) (Ammon and Field, 1980; Klein, 1979, 1985; Metro. Wash. COG, 1979; Field and Turkletaub, 1980; Pitt and Bozeman, 1980). Another inorganic chemical of concern is chlorine. Used to backwash water treatment plant sand filters and pool filters, and to disinfect wastewater, it is also very toxic to aquatic life (Klein, 1985).

Petroleum hydrocarbons comprise about 55% of the 6400 mg/kg of oil and grease in street solids (Ammon and Field, 1980) -- concentrations in undiluted runoff are sufficiently high to cause mortality of aquatic organisms. Such organic chemicals were found less frequently and at lower concentrations than the inorganics. Of EPA's 106 priority organic pollutants, 63 were detected in urban runoff sampling (US EPA, 1983). Klein (1985) concluded from his reviews that three insecticides -- chlordance, endosulfan, and lindane -- pose the greatest threat to water quality due to urban runoff. Though organics in urban runoff exceeded EPA water quality criteria less frequently than inorganics, two organics exceeded the freshwater acute criteria, five the freshwater chronic criteria and six seriously exceeded the human carcinogenic criteria. Also, some priority pollutants have criteria below the level of detection by standard laboratory methods and may be present undetected in runoff samples, as evidenced by one NURP analysis of street sweepings.

Klein (1985) noted compounding problems to chemical pollutant inputs. EPA water quality criteria, developed under single-chemical laboratory testing, do not account for chemical synergism (the magnification of toxicity when two substances are mixed). This oversight makes it quite possible that EPA's recommended water quality criteria will not adequately protect aquatic life when applied to urban runoff. Also, a laboratory-derived criteria level pollutant may exceed the ability of an organism to survive when under physiological stress, such as low DO conditions.

The impacts of urban runoff on receiving water quality are very site-specific. They depend on the type, size, and hydrology of the water body, designated beneficial uses and pollutants that affect that use, urban runoff characteristics, and amounts of urban runoff dictated by local rainfall and land use patterns (US EPA 1983). Since the major resources in North Carolina estuaries are biological, following are some examples of biological impacts by urban runoff pollutants. In three comparisons of rural and urban stream communities, urban streams exhibited lower and less stable species diversity. In North Carolina, rural streams had 3.5 to 9 times as many species as urban. In a Maryland study of watersheds, similar save land use, five out of the nine urban streams were devoid of fish; in three of the four with fish, the dominant species was a pollution-tolerant one described as "found where no other fish can live". In the analysis of species diversity for this study, Klein (1979) found a generally direct relationship between the degree of urbanization increase and a decrease in fish diversity.

Pollutant loading is also positively related to the percent imprevious of urban land (Klein, 1979; Kobriger, et al., 1984; Sartor and Boyd, 1972; Polls and Lanyon, 1980; and Metro. Wash. COG, 1979). -- attributable to higher traffic volume, larger surfaces for deposition and washoff, and a higher volume of runoff on a per acre basis. A study by Pitt and Bozeman (1980) demonstrated that impervious urban land uses constitute 5-20% of the surface area, but deliver 30-75% of the runoff pollutant yeild to outfalls, while vacant lots and landscaped areas, 10 and 40% of the surface area respectively, only delivers 5% each of the runoff yeilds to outfalls.

The final NURP report (US EPA, 1983) summarized urban runoff control performance characteristics developed by individual NURP projects. Though not all-inclusive, they did discuss those which were potentially attractive and practicable at a local level. The types of controls were grouped into four major categories: detention devices (wet, dry, and dual purpose detention basins, oversized drain pipes and catch basins); recharge devices (infiltration pits, trenches and ponds, open bottom catch basins and porous pavements); housekeeping practices (street sweeping, sidewalk cleaning, litter containers) and; other (living filter approaches -- grassed swales, wetlands, etc). This report evaluates those practices performance (comparing contaiminants in outflow vs inflow) according to the NURP and other reports, as well as how each practice would function ecologically and practicably on the North Carolina coast.

Detention Devices. These devices contain and detain stormwater runoff letting it discharge at some design rate. Dry ponds, dry between storm

events, contain the runoff for some design storm and release it through a bottom outlet at a set, usually pre-development, rate. Pollutant removal performance ranges from insignificant to quite poor (US EPA, 1983; Pitt and Bennerman, 1985; Metro. Wash. COG, 1983; Randall, et al., 1982) --and, in fact, dry ponds can serve as a pollutant source when flow resuspends materials deposited previously. (Schuler et al., 1985).

Wet detention basins maintain a permanent pool of water and have an outlet designed so a storm's runoff displaces the previous volume -- the storm's residual is retained until the next storm. Wet ponds function by allowing settling of solids and adsorbed pollutants and allowing biological activity to reduce soluble nutrients (US EPA, 1983; Randall, et al., 1982; Pitt and Bennerman, 1985; Metro. Wash. COG, 1983; Schuler, et al., 1985). Performance characteristics ranged from poor to excellent, depending on basin size/urban area ratio and storm characteristics (US EPA, 1983; Randall, 1982; Schuler, et al., 1985). While performance can be excellent for settleable pollutants, studies show that settling will still allow above-criteria levels of pollutants to remain in suspension (Randall, et al., 1982). Long Island (1982) reported fecal coliform reductions up to 96%, with remaining concentrations still 42-2320 MPN/100 ml. Also, increases (254-366%) in coliform concentrations were also evidenced while in detention.

Other problems with detention ponds are related to the validity of the "first-flush" effect, maintenance needs and groundwater impacts. Detention design is based on the first flush concept, that disproportionate shares of pollutant loads wash out in initial storm stages, and that catching and treating the first small percentage of runoff will remove a high percentage of the pollutant load (URS Research Co. 1974; Hartigan, 1985). However, research suggests that while this occurs with solids, it may not for soluble pollutants and it appears not to for bacteria (Klein, 1985; Quereski and Butka, 1979). Problems concerning maintenance and groundwater impacts will be discussed in the section on recharge systems.

Infiltration/Recharge Systems. These systems are designed to enhance infiltration, and pollutant removal is in direct proportion to the runoff volume intercepted and recharged -- affected by service area and soil permeability. Pollutant removals of 50-99% (US EPA, 1983; Long Island, 1982; Schuler, et al., 1985; Metro. Wash. COG, 1983; Chan, et al., 1982) runoff peak reductions up to 83% (Field, Masters and Singer, 1982) have been reported. In addition to very effective urban runoff control, infiltration provides the hydrologic amenity of recharging groundwater (Schuler, et al., 1985; Pitt and Bennerman, 1985).

The two major concerns mentioned for detention ponds are also major problems with engineered infiltration systems -- maintenance and groundwater impacts. These systems are prone to clog and fill with sediment and, to function properly, need periodic maintenance. It has been evidenced that inspection and maintenance of these systems is very difficult and very often overlooked when a private responsibility (Berg and Williams, 1982; Williams, 1982; Jones and Jones, 1984; Pennell, 1980). Therefore, unless public maintenance is required, the continued functioning of these engineered systems cannot be guaranteed or expected.

The NURP (EPA, 1983) reports that most pollutants of importance are filtered by soil during infiltration, though Long Island (1982) questioned the removal of nitrogen and bacteria. The NURP stated that most pollutants were intercepted before the infiltrate reaches groundwater. However, the NURP test location had at least 20' separation from groundwater, often more, and the final report indicated that findings may not be applicable at locations with shallow water tables. Others emphasized this as well (Long Island, 1982; Water Planning Div., 1977; Maryland SWM Div., 1984). In fact, a Florida researcher studying high water table infiltration, noted that pollutant may not be removed by soil filtration, with resultant deterioration of groundwater or indirect discharge to surface water via groundwater (Wanielista, 1978).

Housekeeping Practices. Reductions in pollutant concentrations or loads by street sweeping were not found to exceed 50% -- statistically, no significant decrease (US EPA, 1983; Waccamaw Reg. P.D.C., 1972). However, the Baltimore URP indicated a substantial difference in runoff quality by maintaining a general level of cleanliness in urban neighborhoods.

Other. With limited data on wetland filtration, it appears that wetlands may reduce urban runoff pollutant loads, especially sediments, heavy metals and nutrients (US EPA, 1983; Assoc. of Bay Area Govts. 1983). However, there is wide disagreement on the use of wetlands to treat runoff (Chan, et al., 1982) -- the fate of heavy metals is not known (Kobriger, et al., 1984) and it is questionable how long a wetland can assimilate nutrients before capacity is reached and a net export begins (Ammon, Huber, and Heaney, 1981; Richardson, 1985).

A number of studies explain how buffers can reduce runoff impacts. Vegetative cover reduces rainfall impact and roots consolidate soil particles and draw out water, decreasing erosion; vegetation reduces total runoff volume by retarding flow and allowing infiltration; vegetation and soil microbial processes can serve to remove nutrients (Palfrey and Bradley, 1982; Maryland SWM Div., 1984; Kercher, et al., 1983; Tollner, et al., 1976; Schltz, Miller and Coulson, 1982; Pitt and Bozeman, 1980). Removal/ infiltration efficiency depends on the relative sizes of upland runoff area, and buffer width, slope, vegetation condition and type, sediment size, properties of underlying soil, rainfall intensity and antecedant soil conditions (Lowrance, Todd, and Amuseen, 1983; Schultz, Miller and Coulson, 1982; Pitt and Bozeman, 1980). Buffers also provide amenities of providing a wetland/upland transition zone and wildlife habitat (Palfrey and Bradley, 1982). The disadvantage of buffers is the reduced development density allowed adjacent to the waterway, thereby generating less development profit.

Recommendations for Coastal North Carolina. The final NURP report notes that, in defining a water quality problem, there must be one of three elements -- first, the denial or serious impairment of beneficial uses; second, a violation of ambient water quality standards and; third, the local perception of a problem. Coastal North Carolina has experienced all three and declines are largely attributable to non-point pollutant sources. To address those aspects of coastal non-point source pollution problem which fall under CAMA jurisdiction, DCM has proposed the following changes to the estuarine shoreline AEC regulations:

- o expansion of the AEC to 200' inland from MHW;
- o expansion of the shoreline AEC to include public trust shorelines;
- o establishing a buffer/setback requirement of 50', of which 30' closest to water must remain in natural vegetation; and
- o establish an impervious surface limit of 15% for all areas within the 200' AEC.

In developing an urban runoff management strategy, considering the drawbacks related earlier for so many of the controls for the high water tables and soils of coastal North Carolina, it was decided to take the advice of Finnemore (1982), who concluded that the optimal management program would have three features: 1) the combination of various best management practices, which together are best suited to local pollutants, conditions and control objectives; 2) where possible, measures should also have uses and benefits besides water quality and, 3) that institutional measures and means should be tailored to support the program objectives and the above features. The proposed regulations have these elements. In examining the explanations for the proposed regulations, it must be remembered that these use standards are not designed so each alone could address urban runoff. In fact, they could not. The approach is an integrated one, and the use standards must be evaluated as such. Following is the rationale for the proposed shoreline AEC use standards.

Extension of AEC Boundaries. In investigation of zone of influence information, it was found that most studies of pollutant origins dealt with watershed boundaries. By definition, what happens in a watershed affects downstream because it is connected by streams, channels, and subsurface flow. And, as Grigg, et al., (1980) suggested, the need is to prevent pollutant sources from being hydraulically interconnected to surface waters. This vast area would be practicably impossible for an AEC, however. Of the 16 other coastal states' programs we examined, specific coastal development jurisdictions ranged from 250' from MHW (ME), to 1000' (MD, MN), the entire coastal area (SC, NJ) or the state (FL). They could not provide zone of influence studies upon which these were based.

Buffer studies were then examined, to see what buffer distances could prevent urban runoff pollutants from being hydraulically connected to the estuary. Palfrey and Bradley (1982) in their review of buffer studies recommended a minimum buffer width of 100' from MHW, 300' to protect water quality from high nutrient loadings. Since many of the coastal waters are nutrient-sensitive, and since many dissolved and colloidal pollutants are carried like nutrients, it was decided that 100' would not provide adequate protection. However, the sandy soils of the coastal area (save peaty areas) have a high infiltration capacity and very slight slope, making 300' likely to be unnecessary. Given these moderating factors, it was decided that 200' from MHW should be a sufficient area in which to overview development, provided that development within that area is kept to as near natural runoff characteristics as possible.

Impervious Surface. Evaluating all runoff controls information, it appears that engineered detention and infiltration controls to minimize runoff are not suitable for the needs of coastal North Carolina. Detention devices cannot remove non-settling pollutants. Bacteria, especially, discharged at urban runoff concentrations, do not die off at a fast

enough rate in saline waters to meet water quality standards (90% die-off in 2-4 days, Waccamaw Reg. P.D.C., 1972). Recharge devices have shown a high probability of contaminating high water table groundwaters, and through movement, surface waters. Since all data indicate that with increasing impervious area in a watershed, the volume of runoff and pollutant load increase proportionally, it logically followed that an impervious limit would be the most effective and appropriate means to minimize runoff. Pennell (1980) suggested this strategy as the most economical and practical control in high water table areas.

Biological assays of streams showed stream impairment when stream quality dropped from good to fair (Klein, 1979). This threshold is reached for fish species diversity when watershed imperviousness reaches 12%. Klein felt that water quality impairment could be prevented if watershed imperviousness doesn't exceed 15% -- 10% in more sensitive systems. When questioned in 1985, Klein (pers. comm.) stated that further research had served to verify his 1979 analysis, that the analysis was valid for estuarine systems and that impervious cover is perhaps the most important control to urban runoff management. Therefore 15% is proposed as the maximum impervious area allowed.

Buffer. As figure 1 shows, 10-20% paved surface in a watershed results in a doubling of runoff over natural conditions, from 10% to 20%. To maintain a natural runoff pattern, the extra 10% could be infiltrated through a vegetated buffer, adequate to remove any nutrients, bacteria or pesticides. Palfrey and Bradley (1982) reported sediments removal efficiencies of bluegrass from 45% for 15 meters (49.2') to 90% for 150' at a 3% slope. Considering the integrated approach, there will be a minimal increase in runoff volume, but solids and soluble pollutants must all be settled or infiltrated out. If infiltration is maximized in a smaller area, by restricting soil compaction during construction (Klein, 1985) and maximizing vegetation, especially dense vegetation and trees (Stephenson, 1981; Palfrey and Bradley, 1982), a 50' buffer should be sufficient to maintain a natural runoff pattern and hydraulically disconnect development in the AEC from the estuary.

Conclusion. Though there have been no NURP-scale studies on urban runoff pollution in coastal North Carolina, the threats to our estuarine resources demand immediate action. Waiting for a North Carolina-specific, conclusive urban runoff study would mean ignoring, for a time, declining water quality and the loss of yet more estuarine resources. The proposed regulations are based on the best available information in 1985, an extensive review of recent urban runoff studies and the experience of other states. The information collected was evaluated against the geologic, hydrologic and ecologic conditions in coastal North Carolina and, with the professional judgement of the DCM, drafted into regulations which attempt to balance responsible development and the protection of water quality. While these regulations will not totally eliminate potential problems, they will permit development which better protects our waters. Should future research prove that these proposals are too conservative or too lenient, they may then be revised to reflect more up-to-date information.

The proposed regulations cannot, however, address all urban runoff/water

quality problems. The problem of preexisting drainage ditches emptying into the estuaries must be addressed, but many connections to these existing ditches lie outside CAMA's permit authority. The Division recommends that the Commission also support the regulation of stormwater collection through NPDES permits for development both inside and outside jurisdiction. To address inputs from upstream, the Commission should support the basinwide management concept for regulatory programs through the state.

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EPA 904/9-84-117
January 1984

EPA

Environmental Impact Statement

Final

North Carolina Barrier Islands Wastewater Management

(a) Surface Water

A major issue of the EIS is the impact of alternative strategies on the surface waters associated with the North Carolina barrier islands. It is difficult to overemphasize the resource value of the coastal surface waters. They provide recreational opportunities for boating, swimming and sport fishing. In addition, they support a large commercial fishing industry based on shellfish and finfish populations. Another primary consideration is the importance of the estuarine systems' dynamics and the dependence of many ocean finfish on the system.

The State of North Carolina has recognized the importance of the coastal waters near barrier islands by classifying most of them as shellfish waters (Class SA) and prohibiting the discharge of wastewaters regardless of treatment level. The use of surface discharges is therefore largely restricted on barrier islands. However, even with the most stringent water use classification, there are still major water quality problems in coastal surface waters. Approximately 46,170 ha (114,000 ac) of shellfish waters within the study area are currently closed to harvesting. Areas of concern include bacterial contamination, nutrient levels and heavy metal contamination. However, most of these problems appear to be generally associated with mainland activities such as land use changes, specific coastal areas such as marinas or discrete environmental phenomena such as flocks of migratory waterfowl.

Few cases have been documented of surface water pollution directly attributable to barrier islands wastewater management practices. A study of nutrient pollution resulting from man's use of the barrier islands was conducted at Surf City, North Carolina (EPA 1975, Shiver and Register 1978). The study concentrated on identifying pollution from septic tanks located on finger-fill canals. This study found that nitrogen compounds, total phosphorus and total organic carbon exceeded background counts in groundwaters and surface waters in proximity to the septic tanks. Contamination of the groundwater is attributed to the fact that the septic tank drain field was placed directly into the aquifer. Little or no separation was found between the nitrification field and the groundwater table, and adsorption of nutrients by soil particles was very poor (Shiver 1981).

It is possible that some surface discharges would also occur under the EIS Strategy. State regulations prohibit discharges to SA waters but do permit discharges to SC (fishery use) waters where adequate assimilative capacity can be documented. However, few future point source discharges are expected since few waters near barrier islands are classified SC. Due to costs, the number and volume of discharges would also be expected to be few. Current water quality standards would be expected to be met under all strategies examined by the EIS.

Degradation of surface water resources by urban runoff is an increasingly serious problem on barrier islands. Development has produced documented negative impacts on shellfish beds bordering several southeastern barrier islands. In some cases these impacts, initially attributed to point source discharges, have been shown to be due to nonpoint sources. A significant nearby example is Hilton Head Island, SC (USEPA, Gannett Fleming Corddry and Carpenter, Inc. and Claude Terry & Associates, Inc., 1981).

ATTACHMENT B

ATTACHMENT B

Coy Batten

Thank you. The next speaker Henry C. Summerson

Henry C. Summerson, Shellfish Biologist, University of North Carolina, Morehead City, North Carolina (S-32)

I'm Hal Summerson. I'm a shellfish biologist with the University of North Carolina, Institute of Marine Sciences. I've been working on shellfish biology problems now for six years in Carteret County and I've been impressed with the gradual deterioration of water quality here in spite of the relative lack of increase in population compared to what I see in the future. I've also been impressed with the number of fishermen that I see moving down from northern states were the water quality has deteriorated to the point that they can no longer make a living. I support the proposed regulations in order to protect the waters here. I wish to also point out that even though the situation is not so bad, the waters are closed. We want to protect the waters prior to their being closed but it's very difficult to go in and tear down the building that makes the closing necessary. Thank you.

Coy Batten

Thank you. The next speaker is Dr. Charles Peterson.

Dr. Charles Peterson, Professor, UNC Institute of Marine Sciences, Morehead City, North Carolina (S-33)

I'm Charles Peterson. I've been a resident of Carteret County for ten years. I'm a professor of marine sciences and biology at University of North Carolina, Chapel Hill's Institute of Marine Sciences here in Morehead City. I also served on the Marine Fisheries Commission of the state of North Carolina. My professional expertise is in shellfish biology and I think I'll give you my reactions to these proposals as a professional shellfish biologist.

My thinking - in my professional opinion - there's no doubt that stormwater runoff in a great problem in increasing the potential for pollution and the actual pollution of shellfish in the waters of North Carolina and elsewhere. Not only is there a problem of runoff in contaminants that we would normally consider pollutants but the freshwater itself can be a pollutant in the sense that these are estuarine waters that have a certain salinity to which the organism are accustomed. Consequently, the freshwater can change that incredibly. In fact you're pushed to the extreme if you increase freshwater runoff with great enough of extent you would actually drive the estuary out of the estuary. You would end up having rivers running right out to the sea like the Amazon where the estuary is really offshore - out in the ocean and no longer in areas where coastal fishermen and recreational climbers could have access to the resources that they now have.

Now of course, we're not threatened with that at the moment but there's no question in my mind as well that increasing impervious surfaces due to various sources of development increases the amount of runoff into the estuaries and consequently represent problems which these regulations attempt to address. I think addressed in a fair and equitable fashion. I have attended hearings and meetings of the Marines Fisheries Commission and on the number of occasions in which fishermen from all over the state have spoken; they speak with a single voice about one problem and that is water quality and what we're doing about water quality.

On the Marines Commission we are unfortunately in a position that we don't directly deal with that issue and that's another reason why I appear here before you today to say that fishermen all over the state as well as recreational planners have a great concern and recognize where their problems lie. They lie with water quality. I urge you to consider some regulations soon and I hope that these are the ones that you choose because I think they are indeed fair. We certainly cannot delay any longer in setting some standards because as your own regulations suggest, building that has already occured are not going to be asked to be torn down even when a storm does it for you. So there's a history of continued development that is not going to be reversed and consequently some regulations are necessary to be on the book to protect us against continued development to a point where we would threaten our resources.

I urge you to pass the regulations as soon as convenient. I think these are quite fair and are regulations that we can live with. I also urge you after you pass these to look in to the issues of agribusiness and the potential for farm land for solving pollution of just this same sort for some of the same reasons. I don't think this is an end. I think it's a beginning but it's a good beginning and I support them. Thank you.

Coy Batten

Thank you. The next speaker is Mark Hooper.

Mark Hooper, Commercial Fisherman, Carteret County Watermans Association, Smyrna, North Carolina (S-34)

My name is Mark Hooper. I'm speaking tonight on behalf of the Carteret County Watermen's Association. It's a group of 250 fishermen and we all pay $25.00 so that we could have a united voice. We're disturbed about water quality. If an area is closed to shellfishing, we can't work that area. It's just as simple as that. Areas that are closed to shellfishing increase in acreage each year. That's more and more land that's been denied us to make our living.

I want to bring up three points. First of all the Division of Marine Fisheries tells about $7,000,000 annually to the state

Coy Batten

Thank you. The next speaker is Tom C. Johnson.

Thomas C. Johnson, Duke Marine Lab, Beaufort, North Carolina(S-39)

Thank you. My name is Tom Johnson. I'm a Marine Biologist at the Duke University Marine Laboratory and I'm the Director of the Duke University North Carolina Oceanographic Consortium. I'm here to support the regulations as they're written. I don't think they're as strong as they should be but the scientific data are absolutely clear on the fact that stormwater runoff effects shellfish quality. I think that we have a kind of nice situation, on this particular problem. Normally we see environmentalists and those concerned about the economy clashing with one another. I'd like to suggest tonight that we're both interested in the ecology, in the environment and I'd say that both sides are very interested in the economy of this area. I'd like to submit that with preservation of the environment, the value of our real estate is going to go up just as the catch of the fishermen are going to go up. So we're going to see the economy improve as well as the environment improve by the passage of these kinds of regulations. I fully support them.

June 1, 1986

Joyce McKenney, M.D., M.P.H.
Box 3431
Duke University Medical Center
Durham, North Carolina 22710

Mr. Bill Kreutzberger
Division of Environmental Management
P. O. Box 27687
Raleigh, North Carolina 27611

Dear Mr. Kreutzberger:

I am writing to comment on the proposed regulations for controlling stormwater pollution on the coast of North Carolina. Having a B.S. degree in biology and several years research experience in coastal and estuarine ecology in Washington, Alaska, and Maryland, prior to obtaining a Masters degree in Public Health and my M.D., I have serious concerns about the effect of pollution from uncontrolled development on our estuarine waters. There is no need for the beautiful estuarine areas of North Carolina to be degraded and lost to natural uses as has occurred in some other areas of the country.

It is documented that without proper control, man's impact on sensitive ecosystems destroys them. We need to take responsibility for controlling and limiting our impact on sensitive ecosystems or we will loose them. Careful controls on development in North Carolina's estuarine waters is essential if such losses are to be prevented.

Sincerely,

Joyce McKenney

Joyce McKenney M.D., M.P.H.

WILLIAM A PHILLIPS M D DERMATOLOGY P A
DISEASES OF THE SKIN
3208 OLEANDER DRIVE
WILMINGTON N C 28403

TELEPHONE 763 7333

May 15, 1986

Bill Dreutzberger
Division of Environmental Management
P.O. Box 27687
Raleigh, N.C. 27611

Dear Mr. Dreutzberger:

I am very hopeful and am urging consideration for a strong storm water control for housing and developments and a serious consideration of agricultural run offs.

I think the article about the Pamlico in the last N.C. Wild Life is certainly self explanatory and those of us who have lived around the water for a long period of time have witnessed an accelerating change in the water quality as well as the plant life.

As a physician I see many patients who use very toxic herbicides and pesticides, are illiterate, and end up with medical problems directly traceable to the misuse of these products. Surely we do not have to wait until the wet lands have been so compromised its become unproductive, as it took so long to establish a relationship between smoking and lung cancer and thalidamide in the production of gross genetic defects.

In my view changes are being seen along the entire coast that are currently unexplained, so the only humane approach is strict containment of any contaminants until long range effects can be evaluated.

Thank you for your efforts .

Sincerely,

William A. Phillips. M.D.

WAP/bl

Dr. Robert A. Parr, Sierra Club, NC (S-80)

I'm a practicing physician in New Hanover County. Previously I obtained a Master of Science degree in Oceanography from Morgan State University. I'm familiar with the scientific opinion of marsh ecosystems on both the west and east coast. I'm also Coastal Watch Chairman for the Cape River Sierra Club.

The estuaries of coastal North Carolina have been viable and environmentally stable for thousands of years. Our ancestors from pre-colonial times up to the recent past have traditionally used these areas for non-destructive recreation and harvesting of seafood resources. Only within the last twenty to thirty years have ill advised and short sighted planning boards and over zealous developers start to build up and destroy these areas for commercial gain. Once high density, unrestricted development is allowed, the fragile marsh ecosystem is destroyed and our natural heritage of a clean and biologically productive coast is gone forever.

The Cape Fear Group Sierra Club consisting of 150 environmentally concerned citizens of New Hanover County, Pender County and Brunswick County strongly support the proposed stormwater runoff regulations. Specifically our group supports the one-half mile jurisdiction zone, stringent controls for high density and commercial development, proposed criteria for impervious coverage, design storms and the requirement that unproven innovative control measures be shown effective prior to wide spread utilization.

It is important to note that these regulations have been developed over years of study by concerned and informed marine scientists. The state environmental commission of Florida, Georgia, Virginia, Maryland and New Jersey have studied the problem of stormwater runoff and reached the same conclusion of marine scientists in North Carolina. Strict regulations must be implemented and enforced to protect coastal waters from degradation and permanent destruction. Although developers, lawyers and paid consultants may argue against these regulations,

the wide spread scientific community on both state and national levels strongly support the design and absolute need for these regulations.

In conclusion, if we are to protect our natural heritage and pass on a clean and productive marine environment to our children, we must act now by supporting these and future regulations. The traditional use of our coastal waters is not for high density developments, strip development and fried chicken stands. We do not want another Miami Beach, Atlantic City or Myrtle Beach in North Carolina. Thank you.

North Carolina
Department of Administration

James G. Martin, Governor
Grace J. Rohrer, Secretary

Office of Marine Affairs
Dr. W. Neal Conoley, Jr., Director

June 5, 1986

Mr. Bill Kreutzberger, Supervisor
Classification and Assessment Unit
Water Quality Planning Branch
Division of Environmental Management
512 North Salisbury Street
Raleigh, North Carolina 27611

Dear Mr. Kreutzberger:

At our May 15, 1986, meeting, the North Carolina Marine Science Council voted to communicate to the Division of Environmental Management our strong support for the adoption of appropriate, effective stormwater runoff regulations.

We realize that such regulation must be tailored to the needs of all users of the natural environment in North Carolina, and that an effective regulatory program will involve the cooperation of all parties far beyond mere adherence to legal standards. The Council is willing to assist in any way possible with this process.

The Council has not investigated the proposed regulations in detail because of the excellent analysis and input your Division has already received from other parties. Therefore, we will not comment on the particulars of those proposals.

However, we feel that it is imperative that appropriate, effective stormwater runoff controls be implemented and enforced as soon as possible. We commend you and the Environmental Management Commission for the excellent job you have done in preparing the proposed regulations, and strongly support the adoption of final regulations at the earliest opportunity.

Sincerely,

Michael K. Orbach

Michael K. Orbach, Chairman
N. C. Marine Science Council

cls

116 West Jones Street • Raleigh, North Carolina 27611 • Telephone 919-733-2290

October 11, 1985

Mr. David W. Owens, Director
Division of Coastal Management
Department of Natural Resources
and Community Development
State of North Carolina
P.O. Box 27687
Raleigh, NC 27611

Dear Mr. Owens:

In response to your kind letter of September 13th. I'm pleased to make comments concerning the proposed runoff rules to be discussed at a public hearing on October 17th, as well as the draft marina standards.

The principles involved in protecting coastal waters from degradation apply to both runoff from development and to marinas:

1. Site selection is most important. A fragile or sensitive site, which impacts on shellfish waters for example, should be treated very differently than sites that are well flushed and/or already commercially developed.

2. Engineering measures, whether involving construction and/or operations, cannot protect nearby waters from the impacts of development. They might reduce or delay impacts slightly, but degradation is inevitable.

3. Given that marinas are associated with, and stimulate, residential and commercial development, marinas should not be located in areas where shellfish-bearing waters would be vulnerable. The only suitable sites for marinas would be adjacent to inlets where vigorous tidal flushing takes place and in areas already dedicated to heavy commercial development. (That is why a marina at Beacon's Reach is indefensible. Adequate sites for marinas exist at Atlantic Beach which would not harm shellfish waters.)

Continued . . .

Specifically, with regard to runoff, waters around the flat lands of the outer banks cannot be served by the measures that have found application in inland areas: detention ponds, infiltration areas, etc. In coastal areas, runoff cannot be adequately contained because of the terrain and the nature of the soils. Accordingly, densities should be limited - say to 10%, but, in addition, extensive areas need to be dedicated to nondevelopment. Secondly, regulatory jurisdiction over development needs to extend much further, because of the easy groundwater movement, say 1000 feet. As now written, the proposed regulations for estuarine shorelines would not protect the coastal waters when all the developable land is developed.

Also, the proposed regulations for marinas need to be more rigorous if the next generation of North Carolinians, and visitors to North Carolina, are to have use of the fine coastal water resources of the state.

Sincerely yours,

Daniel A. Okun
Kenan Professor of Environmental
Engineering, Emeritus

DAO/cat
BCC: Mr. Todd Miller
North Carolina Coastal Federation
Route 5 Box 603 (Ocean)
Newport, NC 28570

787-6120

David H. Howells, P. E.
Environmental Engineer
4913 Larchmont Drive
Raleigh, North Carolina 27612

October 15, 1985

Mr. David Owens, Director
Division of Coastal Management
P.O. Box 27687
Raleigh, NC 27611

Dear Mr. Owens:

I would like to comment on several aspects of proposed regulations of the Coastal Resources Commission relative to shellfish growing waters and will not be able to attend the October 17 hearing for this purpose. Please make this letter part of the hearing record so that it can be considered by the Commission in the promulgation of the final regulations.

The inverse relationship between the quality of stormwater runoff and developmental density of the land has been well documented. While we don't have all the information we would like to have relative to alternative site controls and their specific effects, we do know that increasing density will inevitably decrease water quality, other things being equal. Density controls, impervious surface limitations, and vegetative barriers are about the only ways to deal with the problem.

It is instructive, I believe, to examine how we have dealt with two different areas of concern in this regard. These include waters classified for drinking water (A-1) with only disinfection as treatment and the shellfish growing waters (SA) for the raising and harvesting of shellfish to be eaten raw. In the case of A-1 waters, State regulations limit such waters to uninhabited watersheds with restricted human access. A-1 waters must also be disinfected before consumption. This is in stark contrast to the protection afforded SA waters. Lands contiguous to shellfish growing areas are being developed to urban density levels at which bacterial standards cannot possibly be met. The inevitable result will be the closure of adjacent shellfish growing areas as the standards are contravened and the steady erosion of the shellfish industry in North Carolina. The sooner we recognize that we can't have unlimited development and a viable shellfishery side by side, the better off we will be.

To expect to control pollution from surface runoff from urban development of 30% of the land area within 75 feet of the shoreline is to anticipate the impossible. Engineering works to control, treat, and dispose of such waters at a multitude of sites cannot be expected to be fully reliable even if designed and constructed

to ideal standards because of operational and maintenance problems inherent in such works. The principal line of defense should be developmental density, impervious surface, and vegetative buffers. I suggest that the density be reduced from 30% to 10% and the control perimeter be widened from 75 feet to at least 200 feet. While there is no assurance that these standards will provide the needed protection, it is highly unlikely that anything less will. These figures can later be adjusted upward if justified by actual experience.

I understand the types of economic pressures that must be emerging in the coastal areas from land speculators and developers. But local and state governments must understand that they cannot have their cake and eat it too. The very values that make the coast attractive for living and recreation are being undermined by present developmental density and patterns.

I can't overstate the importance of the State facing up to the realities associated with this problem. It it doesn't, someone will have a lot of explaining to do in the not too distant future.

CC: Dr. Barber
Dr. Everett
Mr. Miller

Sincerely yours,

David H. Howells

David H. Howells, P.E.

ATTACHMENT C

ATTACHMENT C

United States
Environmental Protection
Agency

Region 4
345 Courtland Street, N.E.
Atlanta, GA 30365

EPA 904/9-84-117
January 1984

EPA

Environmental Impact Statement

Final

North Carolina Barrier Islands Wastewater Management

ENVIRONMENTAL IMPACT STATEMENT

North Carolina Barrier Island Wastewater Management
Written Comments

Craig Cogger, Ph.D.
Research Associate, On-Site Waste Management
Soil Science Department
North Carolina State University
Raleigh, NC
August 23, 1983

General Comments

Overall, this environmental impact statement (EIS) is thorough, informative, and well done. The recommended EIS strategy using on-site systems with small community systems in sensitive or higher-density areas appears to be the best overall for most of our barrier islands.

Several of the assumptions and conclusions should be reexamined, however, to make this EIS a better assesment of the monetary, health, and environmental costs of waste treatment on the barrier islands.

Specific Comments

Several specific comments are described below. Most pertain to material which appears a number of times in the document, so specific page references are not given.

1. Separation to Water Table

NC rules require a minimum one-foot vertical separation between the bottom of the absorption area and the seasonally high water table (SHWT). As little as one foot from the surface to the SHWT can be used with a mound system. Data we have collected from experiments on West Onslow Beach suggest that a one-foot separation is not adequate for effluent treatment under barrier island conditions (See Table 1 in Appendix).

I suggest that the EIS recommend a more conservative two-foot separation. The EIS already points out that much developable land meets this requirement, and that alternative systems are available which can be used to increase the separation to the SHWT. A two-foot separation requirement should not have a large effect on development. 7

2. Cost

a. System installation. For low-pressure pipe (LPP) and mound systems, absorption areas are more expensive and pumping systems less expensive than listed in the EIS. Also, in areas where these systems are not widely used costs will be much higher, because of a lack of competition and expertise among installers. 8

APPENDIX

Table 1. Movement of pollutants into the ground water beneath experimental septic absorption trenches in a Corolla soil. May, 1982 - May, 1983

Loading Rate	NH_4^+-N	NO_3^--N	P	Fecal Coliforms	Bovine Enterovirus
	mg/L			MPN/100 ml	PFU/L
	2-foot separation				
Conservative	<0.5	1.9	0.1	<2	<1
Normal	0.6	4.2	0.1	7	<1
Overloaded	0.8	14.6	1.9	25	<1
	1-foot separation				
Conservative	6.1	0.9	1.5	700	2,000
Normal	9.2	1.0	2.8	3,000	3,000
Overloaded	14.0	2.0	3.9	10,000	4,000
	Septic-tank effluent				
	29	<0.5	5.6	300,000	50,000